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ABSTRACT

These two volumes report a pilot study that examined the job-related literacy and numeracy demands made on school leavers who entered selected apprenticeships. Volume I presents narrative materials. Detailed descriptions of literacy and numeracy demands are provided for 10 trades: electrical-fitter-mechanical, fitter-turner-machinist, fitter (diesel and heavy earth moving), motor mechanic, carpenter and joiner, plumber, boilermaker, painter, cook, and hairdresser. These demands are categorized into those related to job performance (job allocation, detailed written job instruction, problem solving, reading with customers), updating knowledge, writing on the job, and literacy demands at college. Other contents include a literature review, methodology, samples of print resources used on the job and in colleges for each trade, results of the application of the FORCAST Readability Formula, and recommendations for changes to selection procedures, training, and trade practices, as well as for further research. Volume II contains these appendixes: sample reading materials used on the job and in colleges, questionnaires used in the study, and readability sampling procedures used on the reading materials. (YLB)

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LITERACY AND NUMERACY DEMANDS
ON
SCHOOL LEAVERS ENTERING
SELECTED APPRENTICESHIPS
IN
QUEENSLAND, AUSTRALIA.

VOLUME I
and
VOLUME II

A. MORRIS and R.G. COPE

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ABSTRACT.

This pilot study sought to demonstrate that it was possible to identify the Literacy and Numeracy demands made on school leavers entering selected apprenticeships.

Ten trades which together accounted for seventy per cent of all first year apprentices in Queensland in 1980 were selected for study. These comprised three Class A trades (Electrical-Fitter-Mechanic, Fitter-Turner-Machinist and Fitter (Diesel and Heavy Earth Moving), four Class B trades (Motor Mechanic, Carpenter and Joiner, Plumber and Boilermaker), and three Class C trades (Painter, Cook and Hairdresser).

Data was gathered by interview and observation in both the work-place and the Technical and Further Education College where the apprentice received trade training. Interviews were conducted with employers, supervising trades-people, technical college staff and apprentices. Examples of print resources used and calculations made were gathered and the "FORCAST" Readability Formula was applied, where possible, to the print resources identified. The study provides a review of literature, detailed descriptions of literacy and numeracy demands made by each trade, samples of print resources used and calculations performed. Recommendations are made for changes to selection procedures, training and trade practices, and for further research.

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CHAPTER 1.

THE PROBLEM.

The question of adequate standards of Literacy and Numeracy has been the cause of much public debate and official inquiry in recent years. Major inquiries or reports whose research has considered Literacy and Numeracy problems include:-

> *House of Representatives Select Committee on Learning Difficulties in Children and Adults.* The Cadman Report, 1976.
>
> Australian Council for Educational Research, *Australian Studies in School Performance.* 1977.
>
> *Committee of Inquiry into Education and Training.* The Williams Report. 1979.
>
> Schools Commission's Report on *Schooling for 15 and 16 Year Olds.* 1980., and
>
> Senate Select Committee on Education and the Arts Report, *Preparation for the Workforce.* 1981.

The evidence provided by these and other inquiries led the Senate Select Committee to assess that:

> "There is ample evidence to support the claim that something like 20 to 25 per cent of school leavers who emerge from Australian schools each year do not have the knowledge and skills as described in the context of this definition (of Literacy)."
>
> (Senate Select Committee on Education and the Arts Report, 1981, p.8).

The definition of literacy which the Committee accepted was an U.N.E.S.C.O. definition previously accepted by Keeves and Bourke in their A.C.E.R. *Studies of Australian School Performance* (1977). This definition states that:

> "A person is literate when he has acquired the essential knowledge and skills which enable him to engage in all those activities in which literacy is required for effective functioning in his group and community, and whose attainments in reading, writing and arithmetic make it possible for him to continue to use these skills towards his own and the community's development".
>
> (Senate Select Committee on Education and the Arts Report, 1981. p. 8).

The most recent report therefore suggests that as many as twenty-five per cent of Australian school leavers may be unable to function effectively in their groups and communities in the areas of reading, writing and arithmetic. The earlier Williams Report, *Education, Training and Employment,* also accepted these data and notes that 'justifiable' complaints about these deficiencies had come from many employers. (1979, Ch. 4. S.14).

Employer groups also made a large number of submissions to the Senate Select Committee claiming that school leavers were inadequately prepared in the areas of Literacy and Numeracy. (Senate Select Committee on Education and the Arts Report, 1981, p.3).

One employer group reported that a survey of its members showed that only forty-eight per cent of respondents were satisfied with the spelling, reading and writing levels of school leavers entering clerical employment. This figure rose to sixty-three per cent for persons entering plant/factory positions and to fifty-two per cent and sixty-five per cent respectively for numeracy skills. (Queensland Confederation of Industry Submission, 1980, pp.4-5).

In its report *Preparation for the Workforce,* the Senate Select Committee drew attention to the differences of philosophy underlying the attitudes of Employers and Educators when interviewed. The Committee concluded that neither side understood nor appreciated the position of the other. Thus, where the Committee understood employers as:

> "...asking schools to prepare young people with sufficient basic training so as to allow them to adapt to the job in question without excessive remedial education".
>
> (Senate Select Committee on Education and the Arts Report, 1981, p.9).

schools misinterpreted these requests and accused:

> "...industry of expecting schools to turn out students who fit into specific occupations".
>
> (Senate Select Committee on Education and the Arts Report, 1981, p.9).

These differences suggested to the Committee that there was little or no evidence of regular or systematic communication between industry and mainstream education. The report may be paraphrased as saying that school leavers do have literacy and numeracy problems which affect their capacity to hold a job and that it is possible that these problems arise because schools lack information about what skills are required in work settings.

A review of the literature on job-related literacy and numeracy revealed that a significant amount of research had been carried out in the U.S.A. and Canada and one further major study in England. The only Australian research into specific Literacy and Numeracy Demands made by jobs concerned numeracy skills. No Australian research into specific job-literacy skills could be located.

Australian schools, therefore, seem to be in a difficult position. Very little Australian research appears to have been done which can clearly identify, for curriculum planners, those literacy and numeracy skills which are needed to function effectively in a work situation. Furthermore, no mechanisms, formal or informal, have been developed which allow employers and educators to engage in meaningful discussions about each others aims and needs.

The present pilot study seeks to examine the roles which literacy and numeracy play in the performance of specific occupations. These job-related literacy and numeracy demands will be examined in relation to a number of representative occupations for which apprenticeship training is required.

It is hoped that the information provided will assist educators and employers to recognize the literacy and numeracy problems which face young people in their transition from school to work. Educators and employers may then be better able to recognize their respective responsibilities to these young people and to move to overcome the misunderstandings which appear to have clouded this area to date.

CHAPTER 2.

RECOMMENDATIONS

Where these recommendations are tied to specific results, detailed in the summary, appropriate paragraph/s numbers are given in parentheses.

SECTION 1: SCHOOL RELATED. (2.07, .08, .09).

1.1 That school curricula be related to the literacy and numeracy demands made on all school leavers and that such programs not be restricted to a relatively small number of students in separate transition programs for 'at-risk' students. (2.09.1, 2.11.2 4).

1.2 That schools place emphasis on reading-to-do as well as on reading-to-learn tasks. (2.09.1, .2).

1.3 That schools place emphasis on the development of oral language skills in problem solving situations. (2.08.1, 2.08.3, 2.08.4).

1.4 That schools place emphasis on developing students' ability to work co-operatively in carrying out reading-to-do and reading-to-learn tasks. (2.08.4, 2.08.7, 2.09.1, 2).

1.5 That schools emphasise the development of reading skills in all subject areas. (2.08, 2.11. 2 4).

1.6 That schools place emphasis on developing students' ability to write formal, technical reports. (2.08.8).

1.7 That schools place emphasis on developing graphical literacy skills. (2.11.2 3).

1.8 That secondary schools emphasise the development and revision of basic mathematics throughout Years 8, 9 and 10. This development should include attention to the four operations with integers, decimals and fractions in both mental and written forms. (2.11.1, .12, 2.12).

1.9 That schools expose students to Imperial measures of length, weight and volume and teach the conversion of these to metric measures. (2.12).

SECTION 2: SELECTION PRACTICES (2.06, 2.07, 2.09, 2.11.2 3).

2.1 That the Industry and Commerce Training Commission (I.C.T.C.) up-date its trade entry requirements by commissioning the development of appropriate trade-based achievement tests in literacy and numeracy. (2.09.3).

2.2 That all persons applying for entry to an apprenticeship be required to complete trade-based literacy and numeracy tests conducted by the I.C.T.C. (2.09.3).

2.3 That employers be provided with the results of I.C.T.C. literacy and numeracy achievement tests for those persons whom they are considering for employment as apprentices. (2.07. 1).

SECTION 3. TECHNICAL AND FURTHER EDUCATION COLLEGES (2.09.2, 2.10).

3.1 That pre-vocational, pre-apprenticeship and apprenticeship courses in T.A.F.E. colleges be encouraged to include trade-based literacy and numeracy courses for all students. (2.09.2, 2.11. 2 4, 5).

3.2 That all reading materials used in T.A.F.E. courses be written in such a form that their reading difficulty level be no higher than the equivalent of Year 10 standard on an accepted Readability Scale. (2.09.2 5, 2.10.2, 2.10.4, 2.10.6).

3.3 That all T.A.F.E. teachers in training be required to complete a course on Content Area Reading to teach them how to develop students literacy skills to an independent learning level within the trade area. (2.09.2 3, 2.10.2).

3.4 That in-service courses in Content Area Reading be made available to practising T.A.F.E. teachers. (2.09.4, 2.10).

3.5 That the Resource Teacher model be developed within all T.A.F.E. colleges in order that the emphasis on literacy teaching can be placed within the regular classroom and not in withdrawal remedial programs. (2.09.2 5).

SECTION 4. FURTHER RESEARCH REQUIRED

This pilot study sought to demonstrate that it is possible to identify specific literacy and numeracy demands made on apprentices in selected trades. The study has provided ample evidence that this is not only possible but that it is highly desirable.

Apprentices encounter very demanding literacy and numeracy tasks, particularly at T.A.F.E. colleges, yet receive very little assistance in the way of organized literacy and numeracy development programs. T.A.F.E. staff attempt to assist students by providing:

* remedial classes;
* teacher-made notes;
* reducing reading and writing demands;
* substituting oral tests for written tests.

DIFFICULTY LEVEL OF READING MATERIALS

Further research appears necessary in order to determine whether:

1. Essential print resources can be re-written to lower readability levels.
2. Students provided with easier-to-read materials make better progress in their apprenticeship training than students who do not receive this aid.
3. Tradespeople provided with easy-to-read materials make more use of them than do tradespeople provided with traditional print resources.
4. Provision of easy-to-read trade reference materials has any effect on trade practices in such areas as problem solving.

SELECTION OF APPRENTICES

Further research appears warranted in the areas of apprentice selection and I.C.T.C. educational criteria for admission to trades. The principal areas of concern appear to be in:

1. development of trade related achievement tests which can be used to predict success in T.A.F.E. college apprenticeship courses;

2. development of a mechanism whereby the I.C.T.C. can assist employers, who lack adequate resources, to test and select suitable candidates for apprenticeship programs.

SECONDARY SCHOOL TRANSITION PROGRAMS

School leavers entering apprenticeships frequently encounter reading material which is substantially different from anything they have experienced at school.

Research is required which will:

1. identify generic skills required by particular trade families;
2. determine whether these generic skills are being taught in existing school courses and, if so, with what results;
3. develop curricula which will allow generic trade skills to be taught in a secondary school context;
4. test the effect on apprentices of pre-apprenticeship generic skills programs in literacy and numeracy.

EXTENSION OF THE RESEARCH

The present pilot study considered Literacy and Numeracy Demands in relation to ten trades. Initial enquiries in retail marketing has shown concern with literacy and numeracy in clerical positions. This type of research, therefore, should be extended to include:

Banking;
Insurance;
Retail Trades, and
General Clerical positions.

CHAPTER 2.

SUMMARY.

2.01 Introduction

2.01.1 This study was undertaken in order to clarify what employers perceived as inadequate literacy and numeracy standards in school leavers presenting themselves for selection as apprentice tradespeople. In common with other English speaking countries, such as, the United Kingdom and the United States, Australia has, in the late 1970's and early 1980's, witnessed a continuing stream of employer complaints alleging the failure of the education system to develop adequate literacy and numeracy standards in school leavers. The official response to these complaints has been to mount a number of enquiries which have looked at such things as:

Education and Training, (Williams Report, 1979),
Schooling for 15 and 16 Year Olds, (Schools' Commission, 1980), and
Preparation for the Workforce, (Senate Committee, 1981).

2.01.2 These enquiries, whilst coming to conclusions which tended to accept that a literacy and numeracy problem does exist in Australia, have not attempted to describe the situation in any detail. The most recent report, that of the Senate Select Committee on Education and the Arts, did attempt to quantify the size of the problem, accepting that there was:

> "ample evidence to support the claim that something like twenty to twenty-five per cent of school leavers who emerge from Australian schools each year do not have the knowledge and skills to (enable them to engage in all those activities in which literacy is required for effective functionings in their groups and communities and whose attainments in reading, writing and arithmetic do not make it possible for them to continue to use these skills for their own and their communities' developments)."
>
> (Senate Select Committee on Education and the Arts, 1981, p.8).

2.01.3 This conclusion tied together a finding of an enquiry, *Australian Studies in School Performance* (A.C.E.R., 1977), with an U.N.E.S.C.O. definition of literacy. The A.C.E.R. report suggested that approximately fifteen per cent of fourteen-year-old students were thought to need remedial help in reading and numeracy. More specifically, the study found that approximately twenty-five to thirty per cent of the students were unable to comprehend the type of prose found in normal school texts and reference books. What the Senate report did not say was that any normally distributed population could be described in these terms if the criterion tasks used were aimed at the average performance of the group as a whole. Thus, in any normal population, generally speaking, one quarter could be expected to perform at an above average level and another quarter at a below average level.

2.01.4 A further finding of the A.C.E.R. study was that standards in Australian schools were comparable to those in Britain, the United States and New Zealand, only marginal differences being found between performance in all four countries. Australian standards would, therefore, seem to be no worse than those found in other English-speaking countries. Is this sufficient justification for saying that nothing needs to be done about raising standards? The Senate Report apparently thought not because it implied that the lower achievement group should be able to function more adequately in group and community situations. The report, however, made no consideration of the implications of this view.

2.01.5 The Senate Committee's use of the U.N.E.S.C.O. definition of literacy therefore needs to be carefully considered. The definition has to be seen as one which relates an individual's performance to the society in which he or she lives. Thus, literacy demands on the child of a farm worker in an under-developed Third World country would be different from those on the child of a computer technician in a developed country. This view can also be applied to individuals within a country such as Australia. The major problem with the Senate Committee's conclusion is that it implies that the literacy and numeracy standards needed to function as an adult in Australian society are known when, in fact, they are not. No study has been made of these demands in Australia. One difficulty with a study of this type is the great variation in demands placed on individuals. Whilst common elements such as driving tests and income tax forms can be identified, job demands and personal preferences are highly idiosyncratic and are much less amenable to description. The Senate Report therefore leaves the major question unanswered. If a quarter of Australia's school leavers do not have the literacy and numeracy skills required to function adequately in today's society, what are the skills which are required and, furthermore, how may they best be taught?

2.01.6 The Senate Committee's answer to this problem was to urge educationists and employers to make closer contacts in order that they could together explore the situation. Educationists need to know what employers expect school leavers to do and employers need to know what skills schools teach. One might here note, that this is a very simplistic view of society. Surely one's life consists of more than school and work! The point of the Report is taken however. Schools do not know what literacy and numeracy demands face their ex-students and to that extent their programs are less well informed and, perhaps, less well conceived than they might be.

2.02 Aims of the Present Study

2.02.1 This study was undertaken in order to clarify the problem facing schools by seeking information on the following questions.

1. *What do employers mean by literacy and numeracy?*
2. *Are employers satisfied with the literacy and numeracy standards of people applying for apprenticeships?*
3. *What literacy and numeracy tasks are trained adult tradespeople required to carry out as they perform their jobs?*
4. *What literacy and numeracy demands are placed on apprentices in the work-place?*
5. *What literacy and numeracy demands are placed on apprentices when they attend trade-training courses at T.A.F.E. colleges?*
6. *What effects do literacy and numeracy standards have on selection of apprentices?*
7. *What effects do literacy and numeracy standards have on trade practices?*

2.03 Limitations of the Study

2.03.1 The size of the workforce and the enormous variety of occupations made it impossible to carry out a comprehensive study of these questions. The pilot study was, therefore, limited to ten trades which recruited large proportions of school leavers entering apprenticeships. It was known that trade apprenticeships required attendance at colleges of Technical and Further Education and could, therefore, provide both work and training environments which could be more readily identified and described than occupations for which no such formalised training programs existed. The ten trades chosen for examination accepted more than seventy per cent of all first year apprentices in Queensland in 1979-1980 (see Table 1.) below.

TABLE 1.

TRADE	NUMBERS ENTERING 1979-80	% OF TOTAL APPRENTICE ENTRIES
I. Electrical Fitter Mechanic	721	11.3
II. Fitter/Turner/Machinist	598	9.4
III. Motor Mechanic	662	10.4
IV. Carpenter and Joiner	650	10.2
V. Painter	160	2.5
VI. Cook	205	3.2
VII. Hairdresser	598	9.4
VIII. Plumber	253	3.9
IX. Boilermaker	495	7.6
X. Fitter (Diesel and Heavy Earth Moving).	244	3.8
1979-1980 Total Apprentice Intake in Queensland.	6,385	71.7

(Annual Report, Industry and Commerce Training Commission, Queensland, 1979-1980, pp.14-15.

Number of Employers Interviewed and Trade Classification

TABLE 2.

TRADE	NUMBER OF EMPLOYERS INTERVIEWED	TRADE CLASSIFICATION
I. Electrical Fitter Mechanic	7	A
II. Fitting,Turning,Machining	7	A
III. Motor Mechanic	4	B
IV. Carpentry and Joinery	4	B
V. Painter	4	C
VI. Cook	6	C
VII. Hairdresser	4	C
VIII. Plumber	4	B
IX. Boilermaker	5	B
X. Fitter (Diesel and Heavy Earth Moving	3	A
Total	48	

2.04 *What Do Employers Mean by Literacy?*

2.04.1 In each business visited the person (or persons) responsible for engaging new apprentices was asked what he/she meant when they talked about literacy. Almost all of the respondents mentioned reading and writing although almost half also mentioned spelling. Typical responses were:

- "Reading, writing, a grasp of the English Language".
- "A well written letter of application".
- "Well they can't spell, they have no idea and can't comprehend".
- "Spelling and reading".
- "Communication through reading and writing, penmanship".

No employers related the question to the workplace or to the demands of the job. Several who mentioned spelling said, when questioned, that no spelling was required on the job but that they regarded spelling as indicative of a person's general attitude. The same also applied to a letter of application, good penmanship and spelling being equated with literacy and effort.

2.05 *What Do Employers Mean By Numeracy?*

2.05.1 Responses to this question were also very general and were not related to specific aspects of the job. Typical responses were:

- "Able to work with figures".
- "A bit of maths".
- "Numbers".
- "Mathematics to a basic degree".

2.06 *Are You Satisfied/Dissatisfied with Literacy/Numeracy Standards of People Applying for Apprenticeships?*

2.06.1 Responses to this question varied, depending on location, size of the employer, and the nature of the trade. For example, the largest employers of electrical/fitter/mechanics in the state received several thousand applications each year for several hundred apprenticeships. Formal standardised tests were used by these employers to measure achievement and aptitude levels. Interviews were then held to distinguish between the highest scoring applicants. Companies in this situation, which was replicated in some engineering firms although with fewer numbers, had no difficulty in recruiting sufficient numbers of apprentices of very high standard.

2.06.2 By contrast, small companies or establishments in smaller isolated towns did not have the same sized pool of applicants from which to choose and consequently had more difficulty in attracting sufficient numbers of suitable applicants. Intellectual demands of the trade also seemed to influence the numbers and quality of applicants seeking apprenticeships. Thus painting, carpentry and hairdressing appeared to attract more applicants with lower literacy and numeracy levels than the electrical or diesel fitting trades.

2.06.3 Although most employers interviewed criticised schools for doing an inadequate job in regard to the development of literacy and numeracy standards, the great majority agreed that they were always able to find apprentices of sufficient ability without too much difficulty. The only exceptions being in small towns such as the new mining towns in Queensland where demand for skilled labour at all levels far outstripped the supply available locally.

2.06.4 It would, therefore, appear that allegations of inadequate literacy and numeracy standards reflect employers' experiences with the applications they receive from the less able section of the community rather than being a general criticism of the whole group seeking apprenticeships.

2.06.5 The comment of one employer illustrates this point:

> "We can usually get ourselves accommodated but, put it this way, we are surprised by the poor standard of some of the applicants we have to knock back".

Another employer produced a file of letters from applicants seeking apprenticeships as boilermakers. Most, he said, were satisfactory, however, a small minority were quite unacceptable and showed poor spelling achievement. Since this employer had only four apprenticeships available and had over one hundred applications on file, the poor spellers did not present an overwhelming problem.

2.07 *Do You Think Literacy and Numeracy Standards are Falling?*

2.07.1 Most, but not all, respondents felt that standards were falling. The following are typical of the comments which suggested poorer standards:

- "All standards have dropped, time sheets are terrible, poor numeracy".
- "Dissatisfied with literacy and numeracy".
- "Dissatisfied - also dissatisfied with applicants inability to carry on conversation, the small range of vocabulary. Dissatisfied with their level of basic maths".
- "A falling off in standards".
- "Dissatisfied, (plus problem of interpreting maths marks)".

- "Dissatisfied - literacy".
- "Spelling terrible, can't fill in forms. Maths O.K.".
- "Dissatisfied with literacy. Maths O.K.".

However, Windschuttle (1979) and others have argued that, because of the tendency to pursue higher levels of education, employers drawing from a fixed level, say Grade 10, are obtaining a lower standard of employee than in previous years).

Notwithstanding these comments, a minority of employers suggested that standards had never been higher. Not only did young people learn more at school, but they also learned more in their trade training courses.

2.08 *What Literacy Tasks are Trained Adult Tradespeople Required to Carry Out as they Perform Their Jobs?*

2.08.1 In order to answer this question experienced tradespeople, in each of the forty-eight establishments visited, were interviewed and observed as they performed their duties. A great range of literacy demands were identified. In general, the more highly rated trades (Class A) required more reading and writing than the less highly rated trades (Class C). However, all trades relied to a very large extent on verbal rather than written instructions for both job assignment and problem solving.

2.08.2 In operational terms this meant that when working in the field a Fitter Mechanic or a Diesel Fitter would be expected to work independently on most occasions, referring to trade manuals and/or official standards when carrying out a task. When faced with a problem, he would be expected to refer to reference manuals or microfiche for solutions. Only when these possibilities were

were exhausted would he be expected to ask for help. In contrast, Class C tradespeople such as Painters were, in the cases observed, actively discouraged by their employers from pursuing any problem solving strategies. Trouble shooting reference materials were not made available. When faced with a problem, the tradesperson was instructed to stop work and call the leading hand, foreman or employer. If this authority could not solve the problem, then the manufacturer's representative was called in. This practice was identified with painting, carpentry and joinery and hairdressing.

2.08.3 In contrast to these field work operations, when working in a central workshop situation with colleagues and supervisors available, *all* trades preferred to ask verbally for advice and direction. A more detailed analysis follows.

2.08.4 Job Assignment

2.08.4 1 As shown in Table 3, all trades received verbal instructions when they were assigned to particular tasks. In addition some tradespeople also received written instructions which, however, varied in their importance. In all the trades considered, except painters and hairdressers, these written instructions were received and/or used on a daily basis. In some cases the work site was several kilometers from the company offices where the instructions were initially issued and the tradesperson then had to remember the job instructions and/or refer to the written instructions with which he had been provided. Written job instructions therefore assumed a far greater significance when working away from the direct supervision and direction of a leading-hand, foreman or employer.

2.08.4 2 In all cases therefore, reading was preceeded by verbal instruction. Given that tradespeople are experienced workers who regularly perform similar, if not identical tasks, the verbal direction can be seen to be a sufficient form of instruction. Written instructions tended to be used for reference, as in looking up an address, or as an external memory, as in the case of motor mechanics who checked to see what jobs had to be carried out on a motor vehicle being serviced.

TABLE 3. TRADESPEOPLE

JOB ASSIGNMENT				
TRADE	Verbal	Written	Verbal and Written	Form most commonly referred to
I. Electrical Fitter Mechanic	###	### **	###	Verbal Instruction
II. Fitter/Machinist	###	### **	###	Verbal Instruction
III. Motor Mechanic	###	### **	###	Written Job Card
IV. Carpenter and Joiners	###	### **	###	Verbal Instruction
V. Painters	###	# *		Verbal Instruction
VI. Cooks	###	### **	###	
VII. Hairdressers	###	# *		Verbal Instruction
VIII. Plumber	###	### **	###	Verbal
IX. Boilermaker	###	### **	###	Verbal
X. Fitter (Diesel and Heavy Earth Moving).	###	###	###	Verbal

USAGE		
	#	Occasionally
	##	Weekly
	###	Daily

IMPORTANCE		
	*	Supplementary
	**	Vital

2.08.5 *What Detailed Written Job Instructions are Used to Carry Out the Trade?*

2.08.5 1 This question was asked to establish whether the tradesperson carried out the job from memory or whether written instructions had to be followed. Table 4 reveals that great differences were found between trades. Electrical fitter mechanics used a wide range of written instructions. This is obviously a highly literate trade. By contrast, cooks, hairdressers, and painters only occasionally referred to detailed instructions as supplementary aids.

Although the range of written instructions shown in Table 4 can, in theory, be expected of tradespeople, in practice very few actually carry out all the tasks shown. In many cases the tasks shown were carried out by the employer, foreman or leading-hand and are then interpreted to the tradesman. For example, plumbers do need to be able to read local government regulations. In practice, however, the employer or foreman usually does this and then gives the plumber verbal instructions. Variations, therefore, occur between employers and it is difficult to generalize about the extent to which the reading of detailed job instructions is required. Under these circumstances, the conclusion has to be drawn that since the job may require such reading at any point in time, the ability to carry out this task is an essential job requirement. Appendix 'A' provides samples of detailed written job instructions for each trade.

TABLE 4. TRADESPEOPLE

	DETAILED WRITTEN INSTRUCTIONS				OTHERS FOR EXAMPLE					
	Trade Manuals	Text Books	Journal Articles	Manufacturer's Instructions	Job Specifications	Drawings and Plans	Regulations	Charts	Computer Print Out	Microfiche
I. Electrical Fitter Mechanic	## **	## **	## *	### **	### **	## **	# **	# *	# *	
II. Fitter/ Machinist	# *	# *		# *		### **		### **	# *	# *
III. Motor Mechanic	# *		# *	### **			# *			
IV. Carpenter and Joiner	# *			# *	### **	### **				
V. Painters				# **	# *	# *				
VI. Cooks	# *		# *							
VII. Hairdressers			# *	# *						
VIII. Plumber				## **	### **	### **	### **			
IX. Boilermaker				# *	### **	### **				
X. Fitter (Diesel and Heavy Earth Moving	## **	### **		### **		# *				## **

USAGE		IMPORTANCE	
#	Occasionally	*	Supplementary
##	Weekly	**	Vital
###	Daily		

2.08.6 Problem Solving

2.08.6 1 The tradespeople interviewed were asked what they would do if they encountered a problem whilst carrying out a job. Would they refer to a reference book or manual or would they ask for help? Workers in all trades said that the usual course of action would be to consult a colleague or supervisor if one were immediately available.

2.08.6 2 Individual differences did occur between workers and worksites. Hence a minority of tradespeople were expected to rely on their own initiative to find solutions in trade guides and manuals. Examples of this practice were found in electrical/fitter/mechanics who serviced lifts and diesel fitter/mechanics who serviced heavy trucks and earthmoving equipment in the field. This was also true, predictably, of all tradespeople forced to work in relative isolation, a situation common in outback Queensland and the Northern Territory.

2.08.6 3 Table 5 shows that reference materials available in some trades, (carpenter, painter, cook, hairdresser) were limited to manufacturer's instructions. In these cases, problem solving consisted of retracing the directions given to ensure that each step had been properly carried out. The other trades required selective use of engineering and electrical drawings, trade manuals and job specifications, tasks which usually required a higher level of literacy than following manufacturer's directions. (See Appendix 'A').

TABLE 5. TRADESPEOPLE

	PROBLEM SOLVING		
TRADE	Reading	Verbal	Form Most Commonly Used
I. Electrical Fitter Mechanic	Yes (Circuit Diagram)	Yes (Colleagues, Foreman)	Verbal
II. Fitter/Machinist	Yes (Drawings)	Yes (Colleagues, Foreman)	Verbal
III. Motor Mechanic	Yes (Trade Manuals)	Yes (Colleagues)	Verbal
IV. Carpenter and Joiner	Yes (Job Specifications or Manufacturer's Instructions)	Yes (Colleagues, Foreman, Manufacturer)	Verbal
V. Painters	Yes (Rarely Used) (Manufacturer's Instructions)	Yes (Foreman)	Verbal
VI. Cooks	Yes (Cook Books)	Yes	Verbal
VII. Hairdressers	Yes (Manufacturer's Instructions)	Yes (Senior or Manufacturer)	Verbal
VIII. Plumber	Yes (By-Laws)	Yes (Foreman)	Verbal
IX. Boilermaker	Yes (Drawings)	Yes (Foreman/Planners)	Verbal
X. Fitter (Diesel and Heavy Earth Moving)	Yes (Trade Manuals, Manufacturer's Instructions)	Yes (Colleagues, operators of vehicles or distributors).	Both verbal and written forms of problem solving were used. Most tradespeople constantly referred to their manuals.

2.08.7 Updating Knowledge

2.08.7 1 Technological or fashion changes mean that trade practices are likely to vary over time. The researchers sought to establish how tradespeople became informed of these changes and the degree to which literacy was involved in the acquisition of this knowledge.

2.08.7 2 Only fifty per cent of the tradespeople interviewed said that they were concerned with updating their trade knowledge. (See Table 6). Of these, diesel fitter/mechanics and motor mechanics were frequently provided with printed up-dating information. Hairdressers kept abreast of changes in their trade by reading fashion and trade magazines and by attending to newspaper photographs of social events. Table 6 shows the responses to this question in summary.

2.08.7 3 Thomas Sticht (1972) has distinguished between reading-to-learn and reading-to-do. Updating knowledge would fall into Sticht's reading-to-learn category. Reading-to-learn is generally a more difficult task than reading-to-do since it implies that the information is new and has to be integrated into the reader's existing knowledge frameworks (schema) if it is to be understood and remembered.

2.08.7 4 The evidence of this study would suggest that relatively few tradespeople engage in this form of reading once they have qualified.

TABLE 6. TRADESPEOPLE

TRADE	UPDATING KNOWLEDGE			
	Are They Concerned with Updating	Read to Update Knowledge	Attend Courses to Update Knowledge	Attend Manufacturer's Trade Nights to Update Knowledge
I. Electrical Fitter Mechanic	Yes	# *	# *	# *
II. Fitter/Machinist	No	# *	# *	# *
III. Motor Mechanic	Yes	### **	# *	
IV. Carpenter and Joiner	No		# *	
V. Painters	No	# *		
VI. Cooks	Yes	# *		# *
VII. Hairdressers	Yes	## **	# *	# *
VIII. Plumber	No	# *		# *
IX. Boilermaker	No	# *		
X. Fitter (Diesel and Heavy Earth Moving)	Yes	### **	# *	# *

USAGE
Occasionally
Weekly
Daily

IMPORTANCE
* Supplementary
** Vital

2.08.8 Writing

2.08.8 1 Very little writing was required of most tradespeople interviewed. Writing which was carried out was usually in the form of a report which described the job completed and the code numbers and quantities of materials and/or parts used. Most writing tended to be carried out by the supervisor rather than by the tradesperson on the job. (See Table 7).

2.08.8 2 Trades requiring most writing of tradespeople were those in service industries such as motor mechanics and diesel fitters. Writing was particularly important where it was done for:

(a) insurance purposes; or
(b) data collection where field experience was evaluated in order to effect modifications.

TABLE 7. TRADESPEOPLE

	WRITING			
TRADE	Reports/Diary	Invoices, Requisitions	Forms/Cards	Main Responsibility for Writing. (Foreman or Tradesperson)
I. Electrical Fitter Mechanic	Yes	Yes	Yes	Tradesperson and Foreman
II. Fitter/Machinist	Yes	Yes	Yes	Foreman
III. Motor Mechanic	Yes	Yes	Yes	Tradesperson and Foreman
IV. Carpenter and Joiner	Yes		Yes	Foreman
V. Painters	Yes			Foreman
VI. Cooks	Yes	Yes	Yes	Tradesperson
VII. Hairdressers	Yes		Yes	Both Tradesperson and Senior
VIII. Plumber	Yes	Yes		Foreman
IX. Boilermaker				Foreman
X. Fitter (Diesel and Heavy Earth Moving)	Yes (detailed job stories required)		Yes	Both tradesperson and Foreman

2.09 Literacy and Numeracy Demands on Apprentices

2.09.1 On the Job

2.09.1 1 Reading and numeracy on the job is extremely difficult for beginning apprentices. Not only do they have to adjust to a situation with its unique range of work practices and social experiences, but they also have to become familiar with the special language registers, reading materials and mathematics problems framed in different contexts to that which they have experienced at school. The problem is exacerbated for most beginning apprentices since everything comes at once.

2.09.1 2 Companies which employ large numbers of apprentices are able to organize their own training programs and are, therefore, able to introduce the apprentice gradually to different aspects of the job. Thus, a developmental sequence can be built up and the beginners' practical experiences preceed any reading which is required. These organizations are also able to program the apprentices' work experiences over the period of the apprenticeship so that the developmental nature of the training program is maintained over the whole of the indentured period.

2.09.1 3 However, smaller companies which employ fewer apprentices do not have the capacity to arrange either an introductory program or a developmental work experience program over the three or four year apprenticeship. In these organizations the company is not engaged on a large range of tasks at any one time and the apprentice has therefore to work on whatever is being done. Job experiences are not developmentally sequenced, and skills are not usually built one upon another. This also applies to reading and mathematics experiences. The apprentice may move from job A which is fairly straightforward to job B which is very complex. Although the apprentice is not personally responsible, being under the direction of a tradesman, his learning experiences are highly personal and he has to fill in any gaps as best he can.

2.09.1 4 It was found that many supervisors overestimated the capacity of their apprentices to cope with job demands at this early stage. For example, one apprentice painter said:

> "I don't know what they mean when they say "two parts of this to two parts of that".

In addition, many supervisors underestimated the reading demands placed on their apprentices. For example, hairdressing apprentices interviewed all found it 'vital' that they read the manufacturer's instructions on any products they used at work. In contrast, some supervisors claimed this was not required and, in fact, they avoided having apprentices use them at all costs.

2.09.1 5 Examples of this type were frequently supplied across the range of trades and appear to show the difference between reading-to-learn and reading-to-do. The tradesperson being very familiar with the task, assumes that the apprentice is equally familiar and has understood instructions which have been given orally. Where the apprentice does not, he/she often turns to a print resource to learn what should be done.

Given the wide range of trade experiences with which many apprentices, especially in small companies, have to cope, the nature of these reading tasks varies tremendously. The problem becomes less pronounced as the apprentice moves through his indenture, gaining wider experience and thus having to rely less and less on reference material for routine tasks.

2.09.1 6 Literacy and numeracy tasks for apprentices therefore vary according to the ability of the company to provide a developmental sequence of trade and thus literacy and numeracy experiences. In general, the apprentice has to face all the literacy demands with which the tradesman has to deal. However, since the apprentice is in a supervised position, many of these demands are usually not highly significant. On the other hand, since the beginning apprentice lacks sufficient work experience, he/she has to use print resources which the tradesperson takes for granted.

2.09.2 At T.A.F.E. Colleges

2.09.2 1 All apprentices are required to complete additional training at a College of Technical and Further Education. These studies require the apprentice to use all types of print resources. In addition, to those found on the job, the trainee has to make use of text-books, specially prepared notes, and library resources. These materials introduce most apprentices to concepts and problems they have not, and often will not meet in their on-the-job training at their place of employment. Thus, the apprentice's reading-to-learn experiences at college are very demanding in terms of both quantity and conceptual load, besides providing a theoretical framework for what is observed at the work-face, the college also widens the apprentice's knowledge of the trade beyond what is experienced on the job.

2.09.2 2 The significance of this can be seen if we consider the range of employment situations that cooks, for example, can find themselves in. Apprentice cooks may be found in large industrial cafeterias, large and small hotels, and in restaurants ranging from the most exclusive *á la carte* types to the least pretentious highway petrol stations. Other trades, such as electrical fitter/mechanic and boilermakers also work in a variety of highly specialised work situations which provide the apprentice with a very narrow view of the trade. The T.A.F.E. college experience is one way in which this narrow range of experience can be widened.

2.09.2 3 The T.A.F.E. college therefore faces an extremely difficult task in which literacy plays a major role. The relatively short time in college does not allow for much in-depth study and apprentices have to read a considerable amount in order that they can begin to see the full implications of the concepts to which they are introduced. As previously suggested, those apprentices who have encountered particular tasks in the work place approach the relevant reading and mathematics with a rich background of experience which eases the academic task they encounter. Where apprentices lack this background, they encounter much more difficulty with the appropriate reading and mathematics tasks.

2.09.2 4 These differences are illustrated by the following example. Take the case of two apprentice cooks attending the same 'block-release' course at a T.A.F.E. college. Apprentice A works in an *à la carte* restaurant in a metropolitan city centre, Apprentice B works in a large industrial kitchen in an isolated mining town where bulk cooking is the order of the day. The college course requires the two apprentices to follow a recipe. Apprentice A is used to following recipes in French whereas Apprentice B has seen no French and is only required to follow bulk directions, if at all. The two apprentices are faced with the following instructions:

"gratinate under the salamander", and

"melt in a sauteuse and add the spetzli".

Apprentice A being used to such terms and recipes, encounters no problems; Apprentice B has not encountered such terms nor has he/she even followed such directions before. The college course is extremely difficult for the latter, since the literacy demands are not congruent with his or her job experiences. Many apprentice cooks find it difficult to follow recipes and also to make efficient use of the professional texts to which they are introduced. Yet the college has to provide apprentices with this breadth of experience in order that they may move from work place to work place and efficiently carry out a professional cook's duties. The same applies, of course, to all other trades: cooks are used here only as an example. The major point here is that college courses, of necessity, must require a high level of literacy and provide a wide range of experiences in reading and mathematics.

2.09.2 5 Remedial Help

Staff in all colleges and in all trades complained about the poor standards of some, not all, of their students. Consequently, some colleges had remedial teachers who provided special assistance to students usually withdrawn from regular classes. In addition, many teachers modified their teaching programs, reduced the number of research projects they set, and wrote simpler versions of the class textbooks to help these weaker students. This is, no doubt, because a higher level of attainment is required for these trades.

2.09.2 6 Not all colleges had remedial teachers available. Those which did not provide remediation claimed to have just as substantial a problem as those which did. The term 'remedial teacher' is used here advisedly to indicate that the teacher's main role was to withdraw students who needed intensive help. The term 'resource teacher' has deliberately not been used since, in the Queensland High School situation, this term indicates a teacher whose primary concern is to assist other teachers cater for the range of ability in a normal high school class.

2.09.2 7 Teachers' estimates of the number of students who were perceived as requiring remedial help varied and a correlation appeared to exist between the numbers cited and the different trades considered. Thus, large numbers of hairdressers, cooks, boiler-makers, and painters were said to need help. By contrast, relatively few electricians and fitters were placed in this category

2.09.3 Selection Criteria

2.09.3 1 Many teachers complained about the selection procedures used to select people into apprenticeships. The Queensland criteria of Year 8 standard of education for 'C' class trades, Year 9 for 'B' class and Year 10 for 'A' class trades were seen to be outdated and of no value to employers, since students were no longer required to pass Years 8 or 9 in order to be promoted. Selection in larger companies, which used objective selection criteria, ensured that their apprentices experienced fewer literacy and numeracy problems. Students with problems in the two areas came mainly from small firms with no objective selection procedures and a policy of recruiting through family connections or word of mouth. In some cases, it was alleged, Ministerial approval could usually be obtained to waive educational requirements and allow entry to a desired apprenticeship. This practice appeared to throw great strain on T.A.F.E. college teachers, most of whom said they were not trained to cope in their classrooms with problems caused by the low education level of such students. Examples were provided of students who could not read and to whom college tests were administered orally. Whilst the charitable quality of this procedure cannot be questioned, a major philosophical point appears to be at issue. Should apprentices be able to read the trade instructions with which they are provided? Since these instructions contain such exhortations as:

"POISON. Not to be taken!" and

"DANGER. Switch off power before opening",

it would appear to these researchers that allowing the trade qualification of people without a sufficient standard of literacy constitutes a potential danger, not only to the individual concerned, but also to workmates and general public with whom they come in contact. Stock (1976) has suggested that as many as twenty per cent of Australian apprentices have reading abilities below that required to read the trade manuals provided for them. The authors do not wish to over emphasize the extent of this problem but only to draw attention to possible difficulties which can be created by inadequate selection procedures. It appears to us that this problem requires the serious consideration of the Industry and Commerce Training Commission.

2.09.3 2 Many employers, especially of higher class trades, demand higher passes than specified by the Industry and Commerce Training Commission. Larger companies tend to use psychological and aptitude tests. Most also use interviews and take note of the standard of communication on application forms. The ability to communicate clearly and effectively in oral and written form was especially sought by many employers. Thus literacy forms an integral part of the selection process, not only because of its place in the school English pass, (and other subjects), but also as communication in the interview and application forms.

2.10 Readability of Trade Materials

2.10. 1 Although attention has been drawn to the low educational standard of a minority of people accepted into apprenticeships, it should not be thought that the problems all lie in this area. Many apprentices of a reasonably competent literacy standard nevertheless encountered trade problems because of the difficulty level of many of the materials which they were expected to read. The concept of Readability has been developed as a means of indicating just how easy or difficult a piece of prose text is. The researchers recognised the problems associated with the use of Readability formulae and adopted a formula specially devised for trade materials. This formula, the 'Forcast' formula was applied, wherever practicable, to the reading samples collected for each trade and the averaged results are shown in Table 9 p. 147. See also Appendices 'A' and 'D' for examples.

2.10.2 Use of the 'Forcast' formula indicated that all trade materials obtained required a high reading standard. The lowest measure obtained was Year 9.2 reading level for a set of T.A.F.E. notes prepared for apprentice painters. In contrast, a set of manufacturer's instructions for painters was measured at the equivalent of a Year 13.5 reading level. The importance of these figures can be seen when one realises that the educational requirement for painters, a Class C trade, is successful completion of Year 8. This incongruence is further highlighted when one considers the complaints of college teachers that students are frequently encountered with a reading level of below Year 5.

2.10.3 Some materials were identified both by measurement and personal comment as being of an exceptionally difficult reading level. Amongst these, the *Australian Standards*

S.S.A. Wiring Book, used by electricians, and the *Standard Sewerage By-Laws*, used by plumbers, appeared to be the worst offenders.

On the other hand, the trade and up-dating manuals produced by the Caterpillar company, as used by diesel fitter/mechanics at the Hastings Deering plant in Brisbane, were exemplary and showed how complex, technical information could be presented in clear, simple language suitable for everyday trade use.

2.10.4 The producers of print resources (textbooks, trade manuals, official specification standards) appear to show little interest in making the information they contain available to the people for whom it is intended. Literacy problems in T.A.F.E. college courses are tremendously aggravated by the totally inadequate nature of the print resources provided for apprentices. Many appear not to bear in mind that the apprentice is a beginner who needs careful guidance through a complex trade language.

2.10.5 That many students cope with the materials provided appears due to a phenomenon noted by Sticht (1972). Sticht found that many students could make adequate use of print resources even though a comparison of their reading ability and the readability level of the material suggested that the reading level was beyond their capacity. Sticht suggested that this was due to a combination of:

(a) interest and high motivation; and
(b) highly relevant background experiences.

Whilst the first factor may be very difficult to assess, the value of the second has already been noted in those companies which provide well structured, developmental training programs for their apprentices. Students who go to college 'block-release' late in their first and subsequent years have more experience and subsequently a better, richer, conceptual development.

2.10.6 Although examples of apprentices who illustrate this phenomenon can easily be found, Stock's (1976) point that many reading materials are above the level at which apprentices are functioning is borne out by the present study. It appears that efforts are required at both ends of this spectrum. Not only should the selection of apprentices be improved, but more suitable reading materials should be provided for them. In this way, more efficient tradespeople equipped for a broader range of duties could be produced. This aim would appear to have benefits for individual employers who could reduce costs, tradespeople who would be more highly regarded and would obtain more job satisfaction, and the general public, who would receive a better service.

2.11 Conclusion

2.11.1 In Section 2.02, seven research questions were posed. The answers are incorporated throughout the above summary: some are short, others quite complex. Nevertheless, a brief answer is now attempted.

2.11.2 1 *What do employers mean by literacy and numeracy?*

There is no ready answer; many different responses were given, most of them simple, to what now appears to be a trivial question. Looking at the total response to all questions it is apparent that employers are *interested in* various aspects of literacy: ability to read, to communicate effectively both orally and in writing, and spelling. Penmanship is also seen by many as part of literacy.

By numeracy, it is apparent that most employers mean the ability to perform fairly simple multiplication, division, addition, and subtraction with whole numbers, fractions and decimals, either mentally or on paper.

2.11.2 2 *Are employers satisfied with the literacy and numeracy standards of people applying for apprenticeships?*

Larger firms, drawing on a substantial pool of applicants, are satisfied with the standard of people *who are selected.* Smaller firms are likewise generally happy. Companies, usually small, who do not use systematic selection procedures or who do not have a large pool from whom to select have experienced some difficulty with apprentices. (This is reflected at college).

However, the researchers continue to be amazed by the claims of some individuals from companies who say that standards have decreased on the basis that many *rejected* applications are of poor quality in expression, spelling and penmanship! In addition, these attributes are rarely required on the job.

2.11.2 3 *What literacy and numeracy tasks are trained adult tradespeople required to carry out as they perform their jobs?*

The answers to this question form the bulk of this, largely descriptive, research. However, a few useful generalizations can be made.

Higher class trades use more reading than do lower class where oral instructions are preferred, especially in the workshop situation. Reading tasks, when used, are usually carried out by foremen or supervisors and not by tradespeople although exceptions were found.

In almost all trades, workers must understand graphical material. This is information displayed in diagrammatic or tabular form.

Reading which does occur on the job is usually done in order to accomplish something. Hence this can be termed reading *to-do* as distinct from reading *to-learn* which is emphasised in school and college. In all workplaces, reading was usually preceeded and accompanied by oral instructions and discussions. In the great majority of cases, reading was carried out in an oral context which itself was conducted in a highly concrete experiential environment. The reader could, therefore, talk through the reading with an experienced colleague.

Few generalisations can be made about mathematics, requirements varying widely from job to job and, thus, too detailed for this summary. All twenty-four categories of mathematics were used in some occupations, for example, electrical fitter/mechanics. Others, like painters, used very limited mathematics.

2.11.2 4 *What literacy and numeracy demands are placed on apprentices in the workplace?*

Heavy demands are placed on apprentices in literacy and numeracy since these tasks are now set in unfamiliar context. This is less true for firms who have more systematic, developmental training procedures.

2.11.2. 5 *What literacy and numeracy demands are placed on apprentices when they attend trade-training courses at T.A.F.E. colleges?*

The demands at college are higher than on the job. This is legitimised by apprentices having to learn all aspects of their trade at college whereas at work they face only those tasks relevant to the firms' particular jobs. Often these demands at college are a major difficulty for the student (and also college staff).

2.11.2 6 *What effects do literacy and numeracy standards have on selection of apprentices?*

Literacy plays a major part in the selection of apprentices, especially those trades requiring a Year 10 pass in English. Ability to communicate in writing and orally is usually sought by employers for all trades. Mathematics ability, as indicated by school results, is important in selection, again, especially in higher grade trades and in all engineering trades.

2.11.2 7 *What effects do literacy and numeracy standards have on trade practices?*

This survey has shown that reading demands vary considerably both within and between trades. Some trades such as diesel fitter mechanic and electrician have a much higher reading demand than do trades such as painter and hairdresser. In some trades, reading for problem solving is actively discouraged whilst in others it is encouraged. In all trades, wherever circumstances permit, reading is accompanied by oral explanation and discussion. Supervisors in most trades are expected to read and interpret trade demands to the tradespeople they supervise. Reading materials found were all written at a relatively high reading level and, apart from individual exceptions, were not written with the average tradesperson in mind.

The researchers therefore conclude that most employers do not have a high opinion of their tradespeople's reading ability and so seek to ensure that any damaging effects of this weakness are minimized. These employers tend not to provide training in using print materials nor do they actively seek to provide easy to read materials. A self-fulfilling prophesy is therefore perpetuated.

In contrast, a small number of employers do seek to have their workers function more autonomously. These employers do provide training in how to use the print resources provided and do seek to provide easy to read materials.

The researchers are not concerned *per se* in which of these two approaches is chosen by employers. However, they are concerned to point out this choice to employers, many of whom appear unaware of the options. It would appear that more workers could be encouraged to work autonomously if their employers chose to provide appropriate training and reading materials. However, it is an economic decision which lies beyond the parameters of this research.

2.12 Summary of Most Important Literacy and Numeracy Requirements of the Trades.

(See Chapter 5 for a detailed analysis).

2.12.1 Electrical Fitter-Mechanic

Literacy

Electrical fitters and mechanics made frequent use of the *Australian Standards S.A.A. Wiring Book,* manufacturers' instructions and job specifications. When working away from the main work centre, electricians had to use trade publications to help them solve any problems which arose. Employers generally expected electricians to function autonomously on the job, thus placing a great significance on the tradesman's ability to use the trade manuals and handbooks provided. A reading ability of approximately Year 11 was required to make use of the print resources used.

Numeracy

Considerable mathematical ability is required by this trade. A wide range of mathematics is used at a high level. Particular emphasis is placed on the use of algebra and formula substitution and the interpretation of graphs, charts and technical drawings, both on the job and at college.

2.12.2 Fitting and Machining

Literacy

Fitters and machinists made frequent use of engineering drawings and were required to follow these with great accuracy. Once mastered, these drawings tended to be very similar and the tradesman used them principally for obtaining and checking measurements. A reading level of Year 11 appeared necessary to deal with the reading required in the college courses for this trade.

Numeracy

Numeracy requirements for this trade are extensive. The tradesmen make constant use of mathematics on the job and apprentices are expected to have a high standard at college. Almost all mathematical categories surveyed were used but with more emphasis on graphics, technical drawings, fractions and decimals, metric and Imperial conversion and tolerances.

2.12. 3 Motor Mechanics

Literacy

Motor mechanics were required to read written job instructions and manufacturers' instructions on a daily basis. Frequent use was made of trade manuals because Motor mechanics were continually required to update their knowledge as new model motor vehicles were introduced. A considerable amount of writing was also required in order to complete job cards recording work done.

Numeracy

A sound grounding in basic computations and the ability to read tables of figures and technical drawings are important to this trade. In addition, Imperial-metric conversion, use of measurement in instruments like micrometers,and a reasonable grasp of the other mathematic categories is needed.

2.12. 4 Carpentry and Joinery

Literacy

Carpenters and joiners were required to make frequent use of building plans and specifications. No effort to update knowledge was identified in this trade apart from the use of manufacturers' instructions provided with new products,such as glues. Literacy demands, in terms of continuous prose, were minimal once the tradesman had completed his apprenticeship training at a T.A.F.E. college.

Numeracy

On the job, carpenters and joiners must be able to perform basic computations with whole numbers, decimals and fractions, measure and estimate length and area, and read technical drawings. The college course is more demanding, requiring, in addition, fairly wide ranging mathematics ability and especially the interpretation of tables of figures.

2.12. 5 Painting and Decorating

Literacy

On the job literacy requirements in this trade were limited to builders' specifications and manufacturers' instructions. These were generally interpreted by the supervisor and little literacy demand was made on the tradesperson. These minimal demands were reflected in low ability levels in college reading and writing tasks. No problem-solving reference materials were provided.

Numeracy

On the job, painters must be able to do basic computations involving the four operations, especially measurement and length. In addition, at college, the apprentice is expected to work with areas, fractions and decimals, ratio, estimation and basic orthographic projection.

2.12. 6 Cooking

Literacy

Reading on the job was related to recipes, menus and ordering of supplies. The need to use recipes varied according to the type of kitchen. At the highest levels, the demands of this trade were extremely exacting, although in more modest establishments the literacy demands were minimal. At college all apprentices were expected to reach the higher standards however, and this caused considerable difficulty for students with inadequate reading standards.

Numeracy

Numeracy demands on the job are varied in this trade. Mental arithmetic, measurement, Imperial-metric conversion, percentages and use of tables are necessary. College demands on apprentices are substantially higher, with emphasis, in addition to the above, on the use of fractions and decimals and ratio and proportion.

2.12. 7 Hairdressing

Literacy

Literacy demands on hairdressers were laregely related to the individual tradeperson's degree of interest. Those with ambition and/or interest made use of trade manuals and fashion magazines. Those with less interest had no need to pursue such readings. College reading was difficult for many apprentices, particularly in the science components of the course, although following directions also caused considerable problems.

The Readability level of some of the print resources provided was measured as high as Year 13 level. This very high standard may offer some explanation as to why, in general, so little use was made of print resources within the trade. For example, manufacturers appeared to accept almost all responsibility for introducing new products to the trade through 'trade evening' presentations.

Numeracy

Numeracy demands are quite limited, the major ability being the use of addition for dealing with money. However, this is usually done with a cash register or calculator. Depending on the job, useful skills are the estimation of cost, knowledge of measurement, angles, proportion and ratio, and use of tables of figures.

2.12. 8 Plumbing and Draining

Literacy

The most important literacy skill for plumbers was the ability to interpret technical drawings. In day-to-day work, the plumber was expected to be able to read builders plans and specifications, as well as plumbing plans.

Plumbers also needed to be able to interpret complex legal language in *The Standard Sewerage By-Laws.*

Numeracy

A sound grounding in basic computations with whole numbers, fractions and decimals was essential for the plumber as was the ability to measure and calculate area accurately.

An understanding of tolerances was important when installing plumbing on large sites where other piping systems, for example, gas and steam, were also being installed. A basic understanding of geometry, angles in particular, was also important for the plumber.

2.12. 9 Boilermaking

Literacy

The most important skill required by the boilermaker on the job was the ability to read and interpret technical drawings and the tables of specifications listed on them.

Problems were usually solved by asking a foreman, thus the ability to ask questions and retain technical information was essential.

Numeracy

A basic understanding of computational mathematics was required by the boilermaker, measurement was crucial and the tradesperson needed to be able to take accurate measures of length and area in both Imperial and metric measures. A basic understanding of geometry, for example, the measurement and construction of angles, was also essential.

2.12. 10 Fitting (Diesel and Heavy Earth Moving Equipment)

Literacy

The diesel fitter must be able to read the detailed job instructions contained in service manuals and update bulletins. This trade is rapidly changing - and to keep abreast, the tradesperson must read service magazines. The ability to interpret technical drawings was also essential, since much of the information in manuals is in a diagrammatic form. It was essential for the diesel fitter to read tables of figures as all specifications were expressed in tables.

Tradespeople needed to be able to write concise technical reports of the work they completed.

Numeracy

Diesel fitters required a good grounding in basic computations with whole numbers, fractions and decimals. Concepts of area and length were not as crucial as they were in other trades. The ability to use both Imperial and metric measures was crucial, since so much heavy earth moving equipment is American and, thus, still calibrated in Imperial.

CHAPTER 3.

REVIEW OF LITERATURE

A. *LITERACY*

John Oxenham (1980) in a comprehensive review, '*Literacy: Writing, Reading and Social Organization*', defines literacy as the 'ability to read and write'. Oxenham, however, points out the simplistic nature of this definition since it makes no allowance for social setting or performance criteria. Is writing the ability to write one's name or does it imply an ability to express a wide variety of ideas in a conventionally acceptable form? Is reading to be seen in terms of following simple signs or does it extend to complex manuals and literary works?

The answer, Oxenham suggests, lies in the social setting in which the individual is expected to function and in this he reflects the U.N.E.S.C.O. definition of literacy which states that,

> "A person is literate when he acquires the essential knowledge and skills which enable him to engage in all those activities in which literacy is required for effective functioning in his group and community, and whose attainments in reading, writing and arithmetic make it possible for him to continue to use these skills towards his own and the community's development".
>
> (U.N.E.S.C.O. 1962)

1. Definitions of Job Literacy

The literature relating to job-literacy is notable for its lack of agreement on the meaning of the term 'literacy' rather than for an acceptance of what is being considered.

The major researcher in the area of job-literacy, Thomas Sticht (1970, 1972, 1973, 1977, 1978a, 1978b) has regarded 'literacy' as 'obviously' referring to reading ability (Sticht *et al* 1970:9). However, Sticht has also noted that reading is a hierarchical language skill based upon the primary language skills of listening and speaking. Sticht has found the loose association of reading and listening/speaking under the general rubric of literacy to be a handicap and in his later writings has urged that literacy be seen only as reading. Thus in 1968, Sticht *et al* used the title REALISTIC for a major research project which enquired into the literacy demands of military jobs.

> Realistic is an acronym based upon the three literacy skill areas studied - READing, LIStening and ArithmeTIC.
>
> (Sticht *et al* 1970, p6).

In this project, listening was regarded as a sub-component of 'literacy' and arithmetic as a:

> "measure of specific literacy skill consisting of the ability to receive and process information in a highly specific formal and rigorous language".
>
> (Sticht *et al* 1970:9-11).

Whilst, in 1978, Sticht noted that many activities which aimed at improving minimum literacy standards had good intentions but suffered from a lack of clear understanding of what was meant by literacy. Sticht suggests that:

> "...the failure to restrict the definition of literacy skills to tasks involving reading and writing clouds the hierarchical relationship that exists between oral and written languages...".
>
> (Sticht, 1978a:2).

Smith (1974) avoided use of the term 'literacy' and substituted the term 'communication skills'. These he defined as the skills of 'reading, writing, talking and listening'. In the United Kingdom, Latham and Parry (1979, 1980) used the term 'functional reading', which they defined as reading related to a task or role.

Mikulecky and Diehl (1979, 1980) found that the addition of the adjective 'functional' had hindered rather than aided researchers. They suggested that literacy had traditionally been approached as a fixed construct, that is, one either possessed it or one did not; one was literate or one was not. Mikulecky and Diehl suggested instead that literacy, which they saw as reading and writing, should be regarded as a variable construct which varies according to a person's real-life context and purposes. This view was supported by Jacob and Crandall (1979) who urged that job reading demands be seen in terms of the demands and social contexts of particular settings. Thus Jacob and Crandall assert there is no one answer to the question, "What is functional literacy?" Such demands can only be ascertained by on-the-job, ethnographic observation which identifies the circumstances in which reading demands occur. The difficulty of isolating reading from other language modes, listening, speaking and writing was recognised by Moe *et al* (1980) who, when seeking information about specific literacy skills necessary for success in particular occupations, chose to identify reading, writing, speaking and listening characteristics.

This seems to the present authors to be a much more valid approach to the real-life situation. While it appears that most research into job-literacy has sought to divide and isolate the language skills of listening, speaking, reading and writing, Jacob and Crandall (1979) point out that real-life situations impose varying demands on individuals. In one situation reading may be supported by discussion, example and repeated practice, in another, the worker may be alone and may only be able to refer to written instructions. Job-literacy should, therefore, we suggest, be seen as the sum-total of language modes available to the worker in a particular setting. This study, therefore, seeks to judge the role of reading and writing in relation to the social contexts associated with job and college performance.

2. Research Orientations

A concern for identifying the literacy demands made on the worker in the work-place dates back to the mid-sixties. In the United States of America in particular, there was a concern with literacy as a means to employment and, thus, equal opportunity (Kirsch and Guthrie, 1977).

The seminal research work in job related literacy was that carried out by Thomas Sticht and his colleagues for the U.S. Army forces (1970, 1973, 1975) and U.S. Navy (1974). A major incentive for this work was Project 100,000 (1966) a project designed to admit to the Army 100,000 men who had previously been disqualified because of low mental aptitude. It was felt that there was a need to establish the minimum levels of competency required by different army occupations if these men were to be employed to the army's and their benefit. The resulting research spans eight years and employed various methodologies ranging from readability formulae to analysis of job related reading tasks. It has, in fact, provided a framework for most of the other work done in the area.

Concurrently with Sticht, Smith (1973, p.4) in Canada was conducting research for the Canadian Department of Manpower and Immigration into the generic skills, "those overt and covert behaviours which are fundamental to the performance of many tasks" (1974, p.2) of thirty-seven occupations. These skills included reasoning and interpersonal skills as well as literacy and numeracy. A major focus of his work had been the need to identify and formulate appropriate instructional objectives and to cluster these objectives into generic skill clusters for the LINC (Learning Individualised for Canadians) Program.

The pragmatic work of Sticht and Smith provided a base for a number of university based studies such as those of Mikulecky and Diehl (1979, Indiana) and Moe (1980, Indiana). Mikulecky and Diehl surveyed the literacy demands of one hundred occupations ranging from professional to untrained workers. Moe *et al* (1980) collected data on the literacy and numeracy demands of eight occupations both in the workplace and in the training situation. Like the work of Smith, Moe's research findings are incorporated into curriculum recommendations for adult education programs.

In Britain, the Sheffield Occupational Functional Reading Project, the only substantial investigation of job related literacy which has been reported to date, was also conducted from an Educational Institution although with the support of the Sheffield Metropolitan District Council. Latham and Parry (1979) the co-ordinators of the project collected large volumes of job related materials from selected workplaces, industrial training boards, colleges of further education and local careers services. They then constructed a criterion referenced test of occupational functional reading ability for sixteen-year-old school leavers entering the workforce.

3. Data Collection

Sticht *et al* have conducted numerous research projects and have collected data in various ways.

In project Realistic (1970) job incumbents in each of three military occupational specialities were given a structured interview. They were asked to describe a typical work day and to bring in job related material.

In 1975 Sticht interviewed army cooks, mechanics and supply specialists on their job sites.

In 1976 Sticht *et al* interviewed one hundred and eighty naval personnel - students, instructors and active job performers in ten job fields.

Smith (1974) used a ten page interview schedule, the Diehl and Mikulecky Job Literacy Survey, to collect information relating to job related literacy from one hundred occupations.

Latham and Parry (1979) visited a representative sample of firms in Sheffield to give a broad range of industries and types of jobs, a wide range of materials was collected from these places. We are told that process for selecting these places has been discussed in their chapter of D.V. Mackray's book, *Growth in Reading,* (1979).

Moe *et al* (1980) visited three job sites and three vocational college courses to collect job related reading samples of talk and writing on eight occupations.

Jacob and Crandall (1979) promote the need to carry out sustained on-the-job observations in order to verify worker's self-report descriptive of the literacy demands of their jobs. This ethnographic research approach is required, they claim, because workers tend to overlook or misconstrue literacy demands made on them thus under-report the demands of their jobs. Jacobs and Crandall suggest that role-playing of the job by the researcher provides further clarification of these demands.

4. Analysis of Data

To assess the demands placed on the worker by job related reading materials, researchers have employed a number of different strategies - *the use of readability formulae, content analysis - task analysis -* and *linguistic analysis.*

Readability

One method which has been widely used to assess the readability of written material is the readability formula. Dale and Chall (1948) suggested that:

> "in the broadest sense readability is the sum total (including interactions) of all those elements within a given piece of printed material that affects the success which a group of readers have with it".
>
> (p.13).

Readability has been determined by the structural features of the text, the average word length, sentence length and other quantifiable aspects of the text. A number of readability formulae have been devised, the most commonly used being the Fry, the Flesch and Dale-Chall formulae. Unfortunately, these readability formulae were primarily designed with school material in mind and although researchers into job-literacy used them, (Moe, 1980 and Sticht *et al* 1970) when faced with job related materials they are inadequate.

Thus, Caylor and Sticht (1973) developed 'FORCAST', a simple readability index which could be applied to the distinct technical style of army and naval manuals designed for young adult male population. 'FORCAST' has also been used by Mackovak (1974) in the navy and Mikulecky and Diehl (1979).

Whilst 'FORCAST' may have some value in its analysis of the surface structure of the text, it fails, as do most formulae, to consider the semantic content of the text, as well as the tables and graphs which are such an integral part of job related reading. Sticht (1978), writing five years after his development of 'FORCAST', admitted:

> "Since readability doesn't account for the graphics we know it is not a valid overall indicator of the literacy demands of a job".
>
> (p.33)

The analysis and estimation of the difficulty of graphic aspects of texts remains one of the most difficult issues facing those seeking to determine the demands of job related materials at the present time.

It is possible that some insight into the way in which the reader at work uses graphic information may be gained from a research approach which uses observation, to take into account the total work situation. As Jacob and Crandall (1979) point out;

> "documents do not stand alone ... what skills are involved in using them? ... does a person record information on them or abstract information from them?"
>
> (p. 5).

Content Categorisation

The content categorisation employed by Sticht *et al* (1970) in project REALISTIC attempts to identify the deeper demands placed on the reader by the text. He lists six types of content categories which identify job reading tasks and information is categorised according to:

(a) the type of information sought, and
(b) the type of content objectives.

Definition of Content-Type Categories from Project REALISTIC

(Sticht *et al* 1970).

1. Standards and Specifications

   Content setting forth specific rules or tolerances to which task procedures or the completed product must conform.

2. Identification and Physical Description

   Content attempting to symbolically represent an object via an identifying code - (stock #, nomenclature) and/or by itemising its distinguishing physical attributes).

3. Procedural Directions

   Content which presents a step-by-step description of how to carry out a specific job activity. Essential elements are equipment/materials/ingredients to be used, and how they are to be used, with presentation organised in a sequential step-wise fashion.

4. Procedural Check Points

   Content which presents a key word or highly summarised version of what should be done in carrying out a task rather than how it should be done. This content differs from the content classified under Procedural Directions in that it assumes the user knows how to carry out the steps once reminded that the step exists and/or reminded of the decision factors which determine whether the step is required.

5. Functional Description

   Content which presents an operating (cause and effect, dependency relationships) description of some existing physical system or subsystem, or an existing administrative system or subsystem.

6. Theory

Content which describes a system of interrelationships among factors in a generalised physical subsystem or system (e.g. internal combustion engines), a generalised version of an administrative system, or in any type of abstract conceptual system.

These categorisations would be used in the following way. The task of obtaining the gap specifications for a spark plug from a paragraph of information in a text, would fall into the following categorisations:

- Type of information sought:
  standards and specifications;
- Content type:
  functional description, standard paragraph format.

Obtaining the same information from a tabular display would be classified:

- Content type:
  standards and specifications, tabular format.

Sticht *et al* (1970) does not make clear his criteria for establishing tabular and standard paragraph format [1] and this kind of distinction is clearly important when we consider the point he makes in a later paper that in naval reasearch only thirty per cent of the reported reading tasks involved texts only, two-thirds used figures or figures and text combined. (Sticht *et al* 1978, p.25)

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[1] As mentioned earlier, Mikulecky and Diehl (1980) do explore this point in their job literacy survey and ask the reader specific questions about the way in which material is displayed ("total book, part of book, single to triple sheet text", etc. p.74).

Categorising material by content in this manner is clearly more useful than simply allotting it a score with a readability formula. It is significant that the most thorough-going designers of a test for job literacy, Latham and Parry (1979), have adopted this categorisation system. Again, one can see the value of being in the work place observing, asking questions and then categorising material.

Turk-Heineman's job related performance task test for secretaries, employs a similar method for categorising the reading demands of the secretary on the job.

(For example, "Locating information following a specific code in a bulletin...

Locating information in the Table of Contents of the Professional Manual").

Shepherd's (1973, 1978) group reading inventory analyses the reading requirements of high school reading in a similar way.

5. Linguistic Analysis

Latham and Parry (1979) are the only researchers identified who have attempted to apply a linguistic task analysis to job related reading. They distinguish four linguistic categories:

1. referential - where the item poses a task requiring the locating of correct information.
2. regulative - where the item requires an answer in terms of a behaviour, either an act of commission or omission.
3. attitudinal - where the question requires the description of a state of mind or approach to a task.
4. definitive - where the item requires a description of the meaning of a word or words.

These categories were defined by linguists at Sheffield. We are not told what theoretical base was used, nor are we given a clear description of the criteria used to place items in each category. Any attempt at categorising the function of language will appear inadequate in some respects. There is always the danger of making material fit the categories rather than the categories fit the materials.[1] Still Latham and Parry's categorisation opens up a new area in the analysis of job related reading. Hopefully it will form the basis of further research.

Whereas the analysis of samples of job related reading material has been reasonably thorough - the corresponding analysis of writing and oral language has been less detailed. Moe (1980) collected samples of writing both on the job and in training sites. Only descriptive comments are given about these - for example, "The use of standard 'grammatical' English sentence structure was not required ... messages and notes were written in informal, economical style" (p.10). His comments about oral language are similarly descriptive rather than analytical, for example, "oral language recorded at the job sites combined informal styles of speech with job related technical concepts and vocabulary..." (p.12).

Clearly, samples of oral language and written material from the work place can be of great value, if they are carefully and systematically analysed as in M.A.K. Halliday's *Talking Shop* (1978).

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[1] Here, too, we see the value of asking questions and observing the worker as he works.

6. Outcomes

Finally, we may consider the way in which the information from the above studies has been used. It is possible to see two general outcomes of research:

1. The development of ways of assessing job related literacy skills.
2. Curriculum and instructional recommendations relating to job literacy.

The first stage of Sticht *et al* (1970) Project REALISTIC was concerned with developing a valid test of job related reading, specifically Sticht's Job Related Reading Task (JRRT). Later stages in the project produced recommendations for reducing the discrepancy between the skill levels of personnel and the demands placed on them by literacy aspects of their jobs. (A specific example of this can be seen in the writing of 'Shock Action', a manual to improve the performance of tank crews in action). Sticht's research into the nature of job related reading - the use of auding, reading to do and reading to learn must also have important implications for classroom practice.

Smith's work (1974) was directed towards producing a taxonomy of skills which are fundamental to a wide range of occupations. Material from these taxonomies then flowed into the development of curriculum recommendations for adult education and training in Canada.

Mikulecky and Diehl's (1979) research also gives us detailed information on the nature of job literacy. Clearly many instructional implications flow from such findings - but at this stage of their research specific curriculum recommendations have not been formulated. Latham and Parry's (1979) research has been solely concerned with the development of a criterion referenced test of occupational functional reading ability, information about its predictive validity is yet to be published.

The most recently published work in the area, that of Moe *et al* (1980) has identified the literacy needs of ten occupations and makes specific instructional recommendations relating to these findings. Their stated objective was to:

> "provide educators, counsellors and administrators with a description of the literacy requirements of semi-skilled and skilled occupations and training programs to which functionally illiterate adults aspire".
>
> (Moe *et al* 1980, p. 7).

B. NUMERACY

The numeracy needs of the worker in the work place or of the apprentice commencing his trade in that area, have not been extensively investigated. In Australia, as with research in literacy, most recommendations to public inquiries by various bodies have been based on responses to questionnaires or on the opinions of employers. Skills analysis and the systematic observation of what actually happens on the job has been recommended but, as yet, this research approach has not been utilised.

Coupled with the problem of establishing the numeracy requirements of the worker, is the issue of how to categorise and classify those requirements. The classification of basic mathematical skills is not an issue which can be neatly resolved. Clearly, more is involved than simply the ability to perform computations.

The American National Council of Supervisor of Mathematics published a position paper on basic skills in mathematics (1978). They list ten basic skill areas, but lay a primary emphasis on problem solving. Other skills are:

- applying mathematics to every day situations;
- alertness to reasonableness of results;
- estimation and approximation;
- appropriate computational skills;
- geometry;
- measurement;
- reading, interpreting and constructing tables, charts and graphs;
- using mathematics to predict;
- computer literacy.

The US National Assessment of Educational Progress (NAEP) (1978) established a matrix of content (numbers, variables, shape, measurement) by process (knowledge, skill, understanding and application).

The content dimension refers to the subject matter of mathematics and is drawn primarily from the current curriculum of elementary and secondary schools in the U.S.A. The process dimension refers to the mental operations involved in completing the task. As the convenors of the assessment acknowledge people use different mental operations to perform different tasks - and categorisation may, at times, appear to be arbitrary. However, a classification system which attempts to consider both content and process is clearly useful, particularly in the area of school learning.

By contrast, Smith (1974, 1975), in his investigation of skills required by workers in various Canadian occupations, expresses mathematical operations in behavioural terms. Smith is concerned only with behavioural statements of skills not with "notions of skills in abstract terms or in relationship to the cognitive requirements", (1975, p.26). In terms of the N.A.E.P's categorisation system, Smith would only be concerned with the content dimension and the skill subsection of the process dimension. He developed the following taxonomy of the scope and clustering of mathematical skills required by various workers in the workplace.

WHOLE NUMBERS

- Reading Writing & Rounding Off
- Addition & Subtraction
- Multiplication & Division
- Problems

INTEGERS AND FRACTIONS

- Reading Writing & Rounding Off
- Addition & Subtraction
- Multiplication & Division
- Problems

DECIMALS

- Reading Writing & Rounding Off
- Addition & Subtraction
- Multiplication & Division
- Equivalents
- Problems

PERCENT

- Ratio & Proportion
- Reading Writing & Equivalents
- Calculations
- Problems

MEASUREMENT

- Graduated Scales
- Time
- Distance
- Weight
- Capacity

METRIC UNITS

- Distance
- Weight
- Capacity
- Conversions

GEOMETRIC FIGURES

- Plane & Solid Figures
- Sketching & Drawing
- Perimeter
- Area
- Volume

SCALE DRAWING AND GRAPHS

- Scale Drawings
- Drawing to Scale
- Reading Graphs
- Constructing Graphs

INTEGERS AND RATIONALS

- Reading & Writing
- Addition & Subtraction
- Multiplication & Division
- Factoring

INTRODUCTORY ALGEBRA

- Variables & Expressions
- Open Sentences
- Algebraic Solutions
- Powers

In 1977 the Sheffield Region Centre for Science and Technology took an eight per cent sample of industries in their region and gave them a questionnaire regarding their perception of the mathematical needs of school leavers. Amongst other things employers were asked to rate the following according to their importance for the first year apprentice:

1. Mental arithmetic;
2. Whole numbers 4 arithmetical operations;
3. Metrication;
4. Length;
5. Area;
6. Volume;
7. Weight;
8. Simple angles and directions;
9. Simple fractions;
10. Decimals;
11. Use of calculator;
12. Use of slide rule;
13. Use of tables;
14. Percentages;
15. Conversion, fractions, decimals;
16. Ratio;
17. Interpretation of graphs;
18. Interpretation of tables of figures;
19. Statistics;
20. Technical drawings and their interpretation;
21. Estimation, error in lengths, areas, etc.;
22. Estimation, error sets of figures, money;
23. Tolerances;
24. Simple circle work;
25. Simple triangles;
26. Simple trigonometry;
27. Simple algebra;
28. Speeds;**

** Details of the categorisation system used are not given but the list of topics includes a range of both mathematical skills and knowledge. The list was produced in consultation with Advisors and Training Boards.

In 1979, Swinson, using the list of topics prepared by the Sheffield Study Group, sent questionnaires pertaining to the mathematics needed by students leaving school at the end of Year 10 to two thousand five hundred employers. Although response was small (one hundred and forty five completed the questionnaires), the following results were obtained:-

TABLE 8.

SKILL AREA	VERY USEFUL	USEFUL	NOT USEFUL	
Mental Arithmetic	111	22	1	
Simple Addition, subtract, multiplication, division of whole numbers	122	12	1	
Fractions	56	48	30	
Decimals	101	25	8	
Conversion - fraction/ decimal	59	40	29	
Use of Calculator	100	21	11	
Percentages	90	32	10	
Approximation and Estimation	47	44	38	
Interpretation of Graphs	30	43	59	
Interpretation of tables of figures, for example, conversion tables	58	31	35	
Reading scales for measurement	68	27	34	
Simple angles and directions	34	27	65	
Measurement	72	31	29	
Length	64	32	39	
Area	54	30	44	
Volume	60	32	26	
Weight	65	39	26	
Ratio and Proportion	36	48	43	
Statistics	28	43	58	
Simple Circle Work	27	20	80	
Simple Triangles	29	17	82	
Simple Algebra	24	22	81	
Simple Trigonometry	18	19	91	
Speeds	31	37	58	

In 1980 Saunders in the U.S.A. interviewed employers from various occupations asking them which basic arithmetic skills were required by their jobs. In the results section of his paper a large matrix of requirements ranging from basic computation to algebra, trigonometry and computer craft. He also mentions that students using calculators need to have skills in estimation, approximation and quick computation. He is particularly concerned with the need students have for learning strategies to grapple with authentic word problems. An important point which he makes is that in planning curricula we need to anticipate future needs in the area of numeracy (p.13).

Moe *et al* (1980) conducted a study of the literacy needs of ten occupations both on the job and in training. Included in this definition of literacy was mathematical literacy - the ability to express oneself mathematically. Mathematics demands were determined through surveys of materials from job sites and classrooms and from a questionnaire which asked instructors and supervisors to identify the mathematical skills necessary for job success and to estimate the amount of time per week the workers spent using mathematics and reading skills. As in much of the literature in this area what exactly constitutes 'mathematical skills' is not made clear - for example, for an electrician in training in the technical mathematics course "ability in basic trigonometry and all underlying skills were required". A categorisation system is not given. We are told later that such skills involve computation, measurement, word problems, geometry and algebra but a clear statement of all required skills is obviously needed if meaningful curriculum recommendations are to be made.

A number of conferences seeking to determine the numeracy needs of the work place have been conducted both in Australia and New Zealand. In New Zealand, Conor McBride (1978) conducted a conference for the Vocational Training Council and reported on his investigations into the mathematical needs of school leavers entering the work force. He found that "accurate counting recording and the simple use of arithmetic processes on whole numbers are essential in most occupations". (p. 7). He records other valuable information relating to the specific needs of industry (for example, workers in the textile industry need to be able to calculate percentages, ratios and averages for differential yarn feeds, comb and carding yields and so on). Although his information is only based on the opinions of employers, he recognises that:

> "the mathematical needs of an occupation should be determined by a research project which examines the skills used on the job (probably by the use of skills analysis and a critical incidents inventory)". (p. 2).

Ross (1976) organised a conference of concerned people from industry, trade and commerce in Wollongong to discuss junior secondary mathematics and the employer. Although no systematic form of categories, a range of important issues are raised - from claims that apprentices are unable to complete simple computations to their inability to asess magnitude and transpose formula.

In Australia the other major initiators of research into the numeracy demands of trades and trade courses have been those concerned with remediation and curriculum planning in technical education. The emphasis in most of these studies has been on mathematics related to course work at collegesof Technical and Further Education (T.A.F.E.) and has been collected from T.A.F.E. personnel or curricula.

In Queensland a report on the mathematical and science skills required by students before entering apprenticeship courses was published by the Curriculum Branch of T.A.F.E. in March, 1980. The information was gathered from trade teachers throughout Queensland's colleges of T.A.F.E. Teachers were asked to review sixty-four mathematical operations [1] and to state whether the skill was required before entrance to the course or was developed during the course.

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[1] The categorisation system used by Queensland T.A.F.E. is not qualitatively different from that used by the Sheffield Study - each category is examined in more detail, for example, in questions on area. There are specific questions on perimeters, circles, circumferences and square rectangles.

Both the Victorian and Australian Capital Territory divisions of T.A.F.E. have completed research into the mathematical requirements of apprentices in various trade courses. At Canberra Technical College this information was gathered by analysing the mathematical principles used in all stages of each trade, calculators, text books and curriculum from guidelines from this was developed a seven part criteria measure test to be used for diagnostic/remediation purposes. Meadows (1979) working with the Victoria Department of Education has researched the numeracy skills required for successful completion of an apprentice course.

This information was used to construct a measure of mathematical competency for Swinburne Technical College's (1980) study of relationships among apprentices' backgrounds, literacy levels and numeracy skills.

In 1979 Geoff Stevens of the Students' Services Unit of Hobart Technical College published a handbook of trade calculations, the syllabus requirements for each trade in Further Education in Tasmania as well as worked examples of 'real'problems drawn from practical sessions at Hobart Technical College.

Up to this point, as mentioned earlier, most research in this area has been college based. In 1980 Stevens extended his survey to the workplace, in a project designed to ascertain the nature of mathematical usage undertaken by the apprentice tradesman fitter and machinist in their day-to-day work; thirty fitting and machining firms were interviewed in the Southern Region of Tasmania. The results are as yet unpublished.

RESULTS

READING

Extent to which reading was used in the workplace?

How often was it used and how important was it considered to be?

Smith, (1974) reported that:

> "all of the thirty-seven surveyed occupations read and listened at the literal level of comprehension".

Sticht (1976) in his interviews with Navy personnel, found that considerable reading was involved on the job, particularly in the more technical trades.

Moe (1980) found that most of the workers he surveyed across ten occupations were required to read at some point. The extent to which they read did vary (for example, an electrician reported spending ten - twenty-five per cent of his time reading, whereas a welder had very little reading to do, even this usually only consisted of single word information. Reading was often repetitive with key information being consulted daily. Generally, the literacy demands of the workplace were more extensive than those of the training situation.

Mikulecky and Diehl (1980) in their survey of some one hundred occupations found that ninety-nine per cent of workers do some reading each day: overall the average amount of time spent reading was one hundred and thirteen minutes. Eighty per cent of those surveyed considered the reading to be 'important' rather than 'vital' to the completion of the task.

Sticht (1976), Moe (1980) and Mikulecky and Diehl (1980) all note the repetitive nature of much on-the-job reading. Sticht suggests that this may be the reason......

What kind of reading was done in the workplace?

Smith (1974) found that all of the thirty-seven occupations he investigated were required to read forms, ninety-seven per cent read books and manuals, by contrast, a much smaller proportion read schematics and graphs. In terms of comprehension[1] he found that fifty-four per cent read at an interpretive level whereas only eleven per cent read at an evaluative level.

Sticht (1976) found that sixty-two per cent of the material read by Navy personnel involved the use of figures, (only thirty-two per cent of the sample read only textual material). Sticht also made the distinction between reading to-do (this, for example, could involve looking up and reading information which was used to accomplish the job task and could then be forgotten) and reading-to-learn (reading in which the information read was to be learned for later use). He found that sixty per cent of the three-hundred and twenty-five reading tasks obtained, were reading-to-do tasks and forty per cent were reading-to-learn tasks. Sticht *et al* (1976), interviewing students, instructors and job incumbents found students used reading-to-learn skills, most job incumbents tended to use reading-to-do skills more.

Mikulecky and Diehl (1980) found that 51.6 per cent of the reading performed on-the-job was only a few pages long. Connected text was used more than charts, graphs and tables (49.9 per cent to 33.4 per cent) although graphic display was rated as more important than connected prose. Mikulecky, and Diehl examined reading in terms of Sticht's "reading- to-do' and 'reading-to-learn' model, they found that most of the reading their subjects did was 'reading-to-do'. Sixty per cent of the material was read daily and twenty-two per cent was read one - four times a week. Thus, in Sticht's terms, most of this reading was an "aid to external memory", something that was read whenever necessary in order to complete a task, not reading-to-learn *per se*.

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[1] Interpretive - "read written materials that require you to generalize, explain or make comparisons".
Evaluative - "judge the value or usefulness of written material" (Smith, 1975, p.56).

Readability: how difficult was job related reading?

As mentioned earlier in the Literature Review, the assessment of the difficulty of job related reading, particularly material containing graphical material, is difficult. While acknowledging the problems associated with using readability formulae, most researchers have used them to assess their materials.

> Caylor (1973) working with Sticht, using the FORCAST formula, estimated that more than half the reading materials in each of seven military occupational specialities exceed the Grade 11 level of difficulty.
>
> Moe *et al* (1980) used Dale-Chall and Fry formulae to estimate readability of on-the-job reading materials and reading materials used in the vocational training program. Materials ranged from Eight Grade (in the case of welders) to college graduate level.
>
> The reading required of account clerks, draftsmen, electricians and secretaries on the job had a higher readability estimate than did the reading required by the training program associated with these occupations. By contrast, the readability estimates of reading materials used by heating and air conditioning mechanics, licensed practical nurses and welders on the job were lower than those of reading materials used in training programs. There was little difference between the readability estimates of materials used by automotive mechanics, industrial maintenance mechanics and machine tool operators on the job and materials used in training programs.

Mikulecky and Diehl (1980) applied the FORCAST readability formula to material presented by fifty-seven of their one-hundred and seven subjects and found that material averaged a grade equivalency of 10.9. They did, however, note that because of the small sample and the problems associated with readability formulae "their results were probably not generalizable" (p. 61).

Writing on the job and in training.

Smith (1974) and Moe (1980) examined the nature of writing on the job.

Smith found that all of the thirty-seven occupations surveyed were required to fill in words and phrases on forms, fifty-one per cent were required to write notes, only five per cent were required to write technical reports.

Moe *et al* (1980) surveyed the writing required on-the-job and in the training programs of ten occupations. In all occupations some ability to write was required - although in some occupations (for example, welding) one or two words written on a form was all that was required. In most occupations writing requirements both on-the-job and on training programs focussed on concise communication of important information rather than on grammatical correctness.

Secretaries seemed to have placed on them the highest requirements in terms of writing, since they were often required to transcribe materials written by others in a formal or technical style.

Writing requirements of training programs were very similar to those on the job.

Mathematics required on the job and in Training

Smith (1975) surveyed the mathematics required in thirty-seven occupations, finding that twenty-four mathematics items were required by all those occupations, more complex tasks, (for example, logarithms, trigonometry and algebra) were only required of the more technical occupations, for example, medical laboratory technicians, draftsmen and machinists.

Moe *et al* (1980) surveyed the mathematics required in ten occupations, on-the-job and in their training programs. All ten jobs required basic arithmetic processes and concepts of measurement, both on-the-job and in their training programs. Draftsmen, electricians and industrial maintenance mechanics were required to use algebra, geometry and trigonometry in the workplace, although only draftsmen required it in the training situation.

Stevens (1980) in his survey of the mathematics used (in the fitting and machining trade in Southern Tasmania, found that all tradesmen were required to perform the four arithmetic processes with whole numbers, decimals and fractions. All tradesmen referred frequently to concepts of measurement and plane geometry. It was essential for them to be able to think both in terms of metric and Imperial measures.

CHAPTER 4.

METHODOLOGY

SAMPLING

Previous attempts in Australia to determine demands on tradesmen/women and apprentices have usually relied on posted questionnaires. The evidence from these surveys is questionable because of the problems associated with poor response rate.

In addition, it would appear that supervisory staff have often drawn up the responses. If so, the results must be suspect because the supervisor, even if he or she was a tradesman/woman, may not have been in that particular trade and, in any case, may have forgotten aspects or not kept up with new knowledge. Hence, in this study, all responses were obtained from interviews.

For each trade area, apprentices, tradesmen/women, supervisors/foremen and employment officers were interviewed. There were no existing guidelines to the number of subjects that should be questioned. Hence the principle of diminishing return was used.

After interviewing several subjects in the one area, the research on that group would cease when the interviewers felt that no significant new data was being added in successive interviews. In quantitative research, this cut-off could be achieved with statistical significance.

It was decided not to select randomly but to procede with businesses recommended, usually by college staff, on the basis of their accessibility and co-operativeness and their concern for training of apprentices. Sites were also selected on the basis of size, with a range of small to big businesses, and on locality, using Brisbane, Toowoomba, Townsville and Mount Isa. In addition, College and Industry and Training Commission staff were interviewed in Darwin.

INSTRUMENTATION

Questionnaires (see Appendix 'B') were developed and trialled for interviewing apprentices, tradesmen/women, employer/supervisors and T.A.F.E. college staff. Project staff developed reliability in research approach by working initially in pairs.

The interviewee was given a copy of the instrument but responses were noted by the interviewer.

Copies of relevant texts, notes and other written material were also collected at all times. A readability estimate of these materials was calculated using Sticht's (1973) FORCAST Formula.They were then categorized[1], described and accompanied by a document sample sheet. (see Appendix A.).

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[1] Using Sticht *et al* (1970) Definition of content type categories.

RESEARCH QUESTIONS

The major thrust of this research was to build up a description of the literacy and numeracy demands on apprentices. However, other important issues became apparent from our reading of the literature and during our preliminary discussions with various groups and individual employers and employees. Hence, other variables were introduced into the study, in addition to the extension of the usual conception of literacy.

These are framed as questions:

Job Allocation

1. Method of obtaining instructions: are these verbal or written?

    1.1 If written, how often does this occur?

    1.2 How important are these to doing the job?

Detailed Written Instructions

2. Are there detailed written instructions to which the worker may refer?

    2.1 What form are these in (manuals, manufacturers' instructions, etc.)?

    2.2 How important are these to being able to attempt a job?

Updating Knowledge

3. How does the worker update knowledge and learn about developments in the trade?

    3.1 What form are these in?

    3.2 How important are these to being able to do the job?

Reading with Customers

4. Is there any reading involved when the tradesperson meets with customers?

    4.1 How often does this occur?

    4.2 How important is this to the job?

5. What mathematics is required on the job?
(The twenty-nine categories are listed in the questionnaires in Appendix 'C').

    5.1 How often is each used?

    5.2 How important is this to the job?

6. How are apprentices selected?

    6.1 What skills are sought?

    6.2 Are there any specific criteria used for selection?

    6.3 Are any industry or trade tests used?

    6.4 Has there been a change in the quality of applicants over the past few years.

7. For questions 1 - 5 above, what are the differences between tradesmen/women and apprentices?

8. For questions 1 - 5 above, what are the demands on apprentices at the T.A.F.E. College compared to the workplace?

9. For questions 1 - 5 above, what are the differences in perception between tradesmen/women and employers?

10. Do the responses to all the above vary with the size of the establishment?

11. Do college staff perceive difficulties with reading in their subject area?

    11.1 If so, how are the difficulties being overcome?

    11.2 Would the staff like to alter teaching strategies to overcome any difficulties?

    11.3 Are there any other ways difficulties could be overcome?

12. What are the mathematical demands on apprentices, as in Question 5, as perceived by college staff?

    12.1 What are the difficulties in teaching mathematics?

    12.2 How are these being overcome?

    12.3 How could they be overcome?

13. What type of writing does the apprentice do at college?

    13.1 Are there any difficulties associated with writing?

14. What is the college staff's perception of employers' selection processes?

    14.1 What skills are they looking for?

    14.2 Are there any trade aptitude tests available?

    14.3 To what extent are these used?

15. Have college staff noticed a change in quality of apprentices over the past few years?

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CHAPTER 5.

LITERACY DEMANDS AT WORK AND COLLEGE IN THE TEN TRADES

(See 2.12 for Summary)

1. ELECTRICAL FITTING AND MECHANICS

RANGE OF THE TRADE

The trade of Electrical Fitter Mechanic is divided into a wide variety of specialist areas. The Electrical Fitter Mechanics sampled as part of this study were employed in:

- working on the installation, construction or repair of control panels, switching centres and generators at a large power station;
- repairing or assembling transformers either on the road side or in workshops;
- repairing and servicing electrical appliances;
- working on more specialist tasks, for example, the repair and installation of lifts or security systems; and
- installing or renewing house wiring systems.

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of specialist areas within the trade).

The literacy and numeracy demands of the job thus vary according to the section of the trade within which the electrical fitter mechanic is involved.

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

Electrical fitter mechanics received both verbal and written instructions. Although written instructions (job sheets, maintenance charts, roster boards, visual display units) were reported as being 'vital' and used 'daily', anecdotal information suggested that verbal instructions (from a two-way radio, or telephone or directly from a leading-hand or foreman) took precedence.

There was a tendency in most large firms for the foreman to do any reading which was required and then tell the tradesperson what they needed to know. This was almost always the case with the apprentice who was told verbally what was required of him.

(b) *Detailed Job Instruction*

Most tradespeople and employers did have detailed written instructions to which they could refer in order to complete a job. Trade manuals were available to most tradespeople but, although considered vital, were not used daily. It was interesting to note that although reading the trade manual was considered to be 'vital' for some tradespeople when they were interviewed, when observed in the workshop it appeared that it was kept in the bottom drawer of the work bench and referred to very little. This suggested that the detailed instructions performed an external memory role where repetitious work had been memorised.

The manuals used varied in format but always contained complex technical language and graphics, circuit diagrams and wiring diagrams in particular.

Manufacturer's instructions/service updates were referred to when a new or modified piece of equipment was in use.

Builder's specifications and plans were read by sections of the trade concerned with installation (for example, fire detectors, lifts, wiring).

Australian standards contained in the S.A.A. Wiring Book were essential reading for electricians. It should be stressed that although this material was available and reported as being used frequently, the major responsibility for reading was with the foreman or leading-hand.

(c) *Problem Solving*

When confronted with a problem in the workplace the electrician could refer to any one of the above detailed job instructions. Some electricians, for example, those working on transformers also had available a trouble shooting chart, the use of which depended on the experience of the electrician, an apprentice might need to read the entire chart, whereas an experienced tradesperson might only need to read a few lines of such a chart. The circuit diagram was a major source of reference and might also be used as a trouble shooting guide.

Reference to print information varied within the job location. For example, when working alone in the field, the electrician would first consult his S.A.A. guide whereas when employed in the workshop he was more likely to ask a colleague or the leading-hand.

(d) *Reading with Customers*

In the fields of electrical work such as contracting and appliance repair, the electrician was involved from time to time in interpreting written instructions or specifications to customers. One tradesperson cited the example of interpreting instructions to a customer who had just had a new stove installed. The contractor was also required to read pricing sheets for costing purposes. On large jobs the tradesperson might refer to the plans to solve a dispute over the location of particular facilities, for example, fire detectors.

2. *Updating Knowledge*

Tradespeople varied in the interest they took in latest developments in their industry. Some felt it was not important to do so - others kept abreast of latest developments by reading manuals for new equipment, update sheets or with courses run by their firms. One company issues a 'Current Awareness Bulletin' from their technical library to keep tradespeople up-to-date with recent advances in the industry. In the electrical field there was a need to update knowledge about electronics. Keen tradespeople did this by subscribing to electronics magazines, reading encyclopaedia or by attending courses run either by the industry or colleges.

The reading level of the above reading materials ranged from 10.94 to 11.8. For further details of these readings see Appendix 'A'.

3. *Writing in the Workplace*

A limited amount of writing was found in the electrical trade, this consisted either of a description of the job to be undertaken or a report on completion of the job. It might involve -

completing a form, often in tabular form, or writing a short report. The tradesperson was also required to fill in requisition forms, these needed to contain concise and accurate descriptions in order for the correct part to be obtained. When necessary a code number transcribed from a mastersheet had to be included.

The apprentice might occasionally be involved in this kind of writing, but generally his main writing task consisted of filling in his log book weekly.

B. *LITERACY DEMANDS AT COLLEGE*

1. *Reading Materials Used at College*

In first year college work [1] the apprentice electrical fitter mechanic was expected to read text books and college notes daily. Students were encouraged to use journals and other research materials in the library for projects.

Details of texts and notes, including their readability estimate, are given in Appendix 'A'.

2. *Problems in Reading*

Problems occurred with the reading of one text in particular, the *S.A.A. Wiring Rules* book - the index was difficult for most apprentices to follow, (consider, for example, the heading 'earthing' where several columns of references needed to be sorted through. Few apprentices understood how to use cross references and reading the tables (for example, cable and conductor tables in the last section of the book) presented a constant source of difficulty.

The vocabulary of the text caused problems for many students and teachers had many enquiries regarding word meaning. Technical content area words were confused, for example, 'convection' and 'convention'. Students also had difficulty with the general language of the text, for example, 'characteristic' was a word frequently misunderstood. Concentration span among apprentices appeared short, thus texts written in continuous form were too difficult and students coped much better with texts which were broken up into 'chunks' which could be treated as separate conceptual units.

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[1] Note: In the initial stages of the project the literacy and numeracy requirements of first year only were examined, later in the study, the literacy and numeracy requirements of all college work were surveyed.

3. *Ways in which these Difficulties were being Overcome*

Because of difficulties with reading, most teachers tended to rely on their own notes in the teaching process. In these notes, texts were broken down to the most basic language and concepts possible. (See Appendix 'A')

Remedial classes were provided by the college for students experiencing difficulty.

4. *Ways in which these Difficulties could be Overcome*

Teachers interviewed suggested that students needed to be taught how to read and study in the content area; how to extract and summarise information.

5. *Writing in College Work*

Students were required to write weekly laboratory reports although apart from these little writing was expected of them. Examination questions were limited to multiple choice questions. Teachers are dismayed by the standard of writing, most students finding it impossible to answer a question which asked them 'to describe' something.

II. FITTING AND MACHINING

RANGE OF THE TRADE

Fitting and machining is a large and varied trade. Tradespeople may work as fitters (assembly and maintenance of machines) or machinists (operating manufacturing machines, for example, grinders, drills and lathes). Turners are machinists who specialise in lathe work. Tool makers have also been included in this discussion as they represent the most precise and skilled section of the trade [1]. Thus, there are:-

- fitters and machinists working in construction of rolling-stock, drilling rigs, cranes and pumps in engineering works;

- machinists working in foundries constructing metal parts for engines and housings;

- toolmakers in both small and large workshops repairing and constructing special purpose metal equipment.

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of specialist areas within the trade).

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[1] In Queensland, the only formal indentures available to the toolmaker are those of fitting and machining. Several employers expressed dissatisfaction with this, in their opinion there needs to be a separate apprenticeship solely for toolmaking.

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

Fitters and machinists received both verbal and written instructions. Verbal instructions from the foreman were the most common way in which the tradesperson found out what job he had to do. Whereas a foreman may be required to read a computer schedule of work or a program drawn up by the drawing office, the average tradesperson's written instructions in this area were confined to technical drawings of the job to be undertaken. These drawings were read daily and were considered to be vital.

Apprentices were mostly told what work they had to do each day, occasionally they would be required to read a job sheet.

(b) *Detailed Job Instruction*

All the tradespeople interviewed did have some detailed job instructions to which they could refer in order to complete a job (see Table 1.).

- Manufacturer's instructions are referred to by most tradespeople usually at the beginning of a job or when new equipment (for example, with computer numerically controlled lathes) is being used.
- Drawings and plans form the bulk of the detailed job instructions used by the fitter machinist. They are usually referred to daily and are considered vital.
- Trade Manuals - for example, the Mechanical Year Book and Steel manuals are referred to occasionally by some sections of the trade.
- Charts of drill and tap sizes, metric conversions and steel hardness are displayed in most workshops and referred to by some tradespeople.

(Examples of the above readings are given in Appendix A.).

(c) *Problem Solving*

When confronted with a problem in the workplace the fitter machinist would refer to any of the above detailed job instructions, his most likely source of reference will, however, be his drawings. Most tradespeople interviewed would ask their foreman, client or the manufacturers what to do in the event of a problem.

Apprentices also talked through work related problems easier with their workmates or the foreman.

(d) *Reading with Customers*

In the fitting and machining trade little reading is done with customers directly. Only occasionally will a tradesperson discuss a drawing of a job with a customer.

2. *Updating Knowledge*

Keeping abreast of latest developments in their trade was not considered vital by the fitters and machinists interviewed. When necessary they would attend a course run by manufacturers (for example, the company installing computer numerically controlled lathes in an engineering shop undertook to teach machinists how to use them) manuals were provided and made reference to in the event of a problem. As in most trades the emphasis here is on training the foreman who then teaches his tradespeople.

The reading level of the above materials ranged from 10.4 to 11.3. For further details of these readings see Appendix A.

3. *Writing on the Job*

Writing required by the fitter machinist was usually limited to reports and records of work done on different contracts. A shift fitter may write a short maintenance report for the next shift. In requisitioning materials, code numbers may need to be filled onto forms. Most of this writing was done by the foreman, the man on the shop floor would write only occasionally, the apprentice wrote even less.

B. LITERACY DEMANDS AT COLLEGE

1. *Reading Materials Used at College*

During their college studies fitters and machinists were expected to read text books and college notes daily, trade manuals and manufacturers instructions were available in practical classes for reference, fitting and machining journals were available in the college library but were not frequently used by students.

The reading level (estimated using the FORCAST formula) of the materials used in the college work required of apprentice fitters and machinists, ranged from Grade 10.4 to Grade 12.3. For further details of these reading materials see Appendix 'A'.

2. *Problems in Reading*

Teachers of fitting and machining did not report any major difficulties with the reading required by their course. In their opinion "texts are readable and well illustrated". Problems were not serious enough to necessitate a major change in teaching strategy.

3. *Ways in which difficulties are being overcome*

When necessary and where possible[1] remedial classes were held at night for students experiencing difficulties.

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[1] This is not always possible, the apprentice legally only works forty hours a week - if the college keep him for longer than this they may be liable for overtime payments.

4. *Ways in which difficulties could be overcome*

Better selection of apprentices would, in the opinion of college teachers, obviate any problems which students do have. In their opinion a pass of one or two in Junior is not a sufficient background for trade courses.

5. *Writing in College Work*

Some writing was required for assignments and examinations in first and second year. The major piece of writing required of fitting and machining apprentices comes in their third year when they had to complete a major assignment. They were required to write 'short', 'sharp' technical descriptive prose with as few correctives (explaining, for example:-

HOW to pull a machine down;

WHAT was wrong with it;

HOW it was repaired) as possible.

Staff reported that this posed real problems for many students.

III. MOTOR MECHANICS

RANGE OF THE TRADE

Motor mechanics is one of the largest trades in Queensland. Tradespeople work on repair and maintenance of motor vehicles at many different locations:-

- suburban driveway garages;
- Government garages responsible for a wide range of Government vehicles;
- dealerships of particular brands of cars;
- heavy vehicle workshops, either Governmental or private industry.

A recent innovation in the training of motor mechanics has been the introduction of a commercial and heavy vehicle strand into the third year of college courses. This provides a specialist training for mechanics working on trucks and other heavy commercial vehicles.

(The examples given were obtained from the sample interviewed and are not meant to be a definitive list of specialist areas within the trade).

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

Motor mechanics received both verbal and written instructions (see Appendix 'A'). Written instructions, in the form of a job card or an entry in the workshop book, were considered vital and were used daily by all tradespeople and apprentices.

(b) *Detailed Job Instructions*

Most motor mechanics referred daily to written instructions in the form of:-

- Manufacturer's Instructions

  (Usually vehicle hand books) and Service Updates. Much of this reading was in a tabular form presenting columns of specifications for different vehicles. In a large Government garage where many different models were serviced - mechanics referred daily to a technical library of different car manuals for settings and specifications.

  In a dealership where cars of the one make were serviced manuals were not referred to as frequently.

  In a service station these were referred to when a new model of car came in for service.

  Mechanics who worked on the repair and maintenance of trucks relied heavily on service updates for information on how to service new components of trucks because new technology is rapidly changing truck mechanics.

- Trade Journals and Text Books.

  Trade journals and text books were referred to only occasionally.

- Microfiche

  Microfiche were consulted weekly by mechanics ordering parts in a large Government agency.

- Australian Standards

  Australian Standards were referred to when new legislation (for example, regarding air pollution) was issued.

(Examples of the above reading materials and their readability estimate is given in Appendix 'A').

(c) *Problem Solving*

In the event of a problem on the job, the trade manuals produced by the manufacturers were available to most tradespeople. (If these provided insufficient information, the tradesperson could phone the manufacturers). However, all tradespeople and apprentices said that their first recourse would be to ask another tradesperson. One motor mechanic who managed a service station stressed the importance of tradespeople obtaining verbal advice from him in the event of a problem. "If you don't know, ask! The customer's car is not for experimenting with".

(d) *Reading with Customers*

Occasionally the motor mechanic was called upon to interpret an operator's manual to the owner of a vehicle.

2. *Updating Information*

Different sections of the industry varied in the interest their tradespeople took in keeping abreast of latest developments in their trade. Rapidly changing technology in the trucking industry meant that truck mechanics must keep up-to-date by reading manufacturer's service bulletins and trade journals. Other tradespeople learnt of new developments in the trade only when confronted with a new model of car which required consultation of the manuals. Motor mechanics naturally learnt much about developments in their trade from their employer or colleagues - for example, tradespeople not trained in using electronic tuning devices were taught how to do this either by their employer, workmates or a representative from the manufacturer.

(The reading level of the above materials ranged from 9.6 to 13.5 . For further details of these readings see Appendix 'A'.

3. *Writing on the Job*

Motor mechanics reported that their trade involved a considerable amount of writing. The tradesperson was required to write 'job stories' that is, reports on the repairs he undertook, and the parts he used. These needed to be written accurately and informatively so that the customer knew what he was paying for. Full accurate job stories were particularly important when a Warranty Claim was involved. Later year apprentices may be involved in this kind of writing. In some Government garages where vehicles were maintained on a routine basis, mechanics will fill in the job card - that is, the card detailing the car's complaint. Mechanics were also required to fill in requisition forms for parts and equipment; this was usually the foreman's job.

B. *LITERACY DEMANDS AT COLLEGE* [1]

1. *Reading Materials Used at College*

During their college studies motor mechanics were expected to read their set text and college notes daily. Trade manuals (usually in the form of manufacturer's specifications) were read in practical classes. In the third year commercial and heavy vehicle strand no text books were used; self-paced learning using audio-visual materials was the main method of teaching. Students were also encouraged to read trade journals, and manufacturers service information.

The reading level (estimated using the FORCAST formula) of the materials used in the college work required of apprentice motor mechanics ranged from 10.5 to 10.8.
for further details of these reading materials see Appendix 'A'.

2. *Problems in Reading*

Both teachers of the motor mechanic's course and the commercial and heavy vehicle strand reported that their students experienced difficulty with the reading which was required of them. Major problems arose with the vehicle manuals published by manufacturers - students had difficulty grasping technical terminology. European manuals were particularly hard to understand in this regard since they contain large amounts of technical language.

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[1] Teachers of both motor mechanics and commercial heavy vehicle courses were surveyed.

Japanese manuals were also difficult to interpret - teachers reported that they were written in 'Japanese English', containing confusing expressions and sentence constructions.

3. *Ways in which these difficulties were being overcome*

Teachers were required to explain all terminology in the simplest possible language. Remedial classes were available in the college surveyed for those apprentices with severe reading problems.

4. *Ways in which these difficulties could be overcome*

A teacher working in the commercial and heavy vehicle strand of the course suggested that students needed to be taught effective reading and study strategies. He also suggested the need for trade based diagnostic reading tests. (At present remedial lessons were given to students who achieved poorly on standardised general tests of reading).

IV. CARPENTRY AND JOINERY

RANGE OF THE TRADE

Carpenters and joiners in Queensland worked on the construction of buildings in many different situations. The range of carpenters and joiners interviewed showed that a tradesman might:

- set himself up in business, building houses or blocks of units, sub-contracting out to other tradespeople plumbing and electrical work;

- he may work as part of a team of carpenters and joiners with a medium sized firm building houses, units or on bigger contracts (small shopping centres and other commercial premises);

- he may work for a large Australia-wide building company being assigned to construction sites (ranging from the construction of theatres to work on mining sites) throughout Queensland. He could also work as part of a 'labour only' gang which is sub-contracted by such a large firm to work on a particular job.

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of the range of the trade).

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

Carpenters and joiners received both verbal and written job instructions. A carpenter and joiner working in a gang would be told what to do by the leading hand, on a construction site the foreman would tell him what to do. Written instructions might consist of an on site memo from the foreman or a program written up by a building supervisor. They were read daily and considered vital by the tradespeople interviewed. More detailed instructions were in the form of a book of job specifications or plans.

(b) *Detailed Job Instructions*

Detailed written job instructions were available to tradespeople, the reading of these was usually the responsibility of the leading hand or foreman. As one tradesperson put it "the foreman is the plan man". Job instructions identified included:

- Manufacturer's Instructions

  Manufacturer's instructions regarding specifications for a particular product, for example, lock and door fittings were read daily and were considered vital;

- Job Specifications

  Job specifications were usually prepared by the architect and detailed either in a book of schedules or on the plans themselves. They were considered to be essential reading and a foreman would usually read them daily depending on the nature of the job (on some jobs the specification book was worn out in the first week, in others, they were referred to only in the first month of the job).

- Drawings and Plans

  Drawings and plans prepared by the architect were considered vital by the tradespeople interviewed. However, the major responsibility for reading them lay with the foreman rather than the individual tradesman. A foreman usually had his own set of plans, on large sites there were copies of all plans in the site office;

- Australian Standards

  Legal specifications set down by the Australian Standards Association (for example, regarding timber framing and roofing or cyclone regulations) were referred to occasionally by the tradesperson, usually the foreman. This was usually more the concern of the architect who drew up the plans for the job.

(c) *Problem Solving*

In the event of a problem on the job the tradesperson would usually consult the foreman who would be able to consult the book of schedules or manufacturer's instructions for advice. If the foreman, or tradesperson working unsupervised, had a problem with a particular product, he would ring the manufacturer. When a problem arose on large building sites 'a request for information form' may be submitted by tradespeople to the architect.

(d) *Reading with Customers*

The tradesperson (again, usually the foreman) would occasionally be called on to interpret plans or job specifications to a customer, however most of this interpretation was usually done by the architect.

The reading level of the above materials ranged from Grade 9.9 to Grade 13.0. For further details of these reading materials see Appendix 'A'.

2. *Updating Knowledge*

The carpenters and joiners surveyed were not particularly concerned with keeping abreast of latest developments in their trade - one suggested that T.A.F.E. courses might be useful in this regard.

Manufacturers did issue information bulletins to keep their customers up-to-date.

3. *Writing on the Job*

Little writing was required of the ordinary tradesperson on the job. The foreman was required to keep a daily diary of work completed, weather, accidents and the number of men at work. In work on a large job a tradesperson may fill in a 'Request for Information Form' which is sent to the architect.

B. LITERACY DEMANDS AT COLLEGE

1. Reading Materials Used at College

During their college studies the major reading required of apprentice carpenters and joiners was the notes provided by the college. No textbook was set for their course work although apprentices were encouraged to read trade manuals and journals in the library.

The reading level (estimated using the FORCAST formula) of the materials used in the college work of carpenters and joiners ranged from Grade 9.7 to Grade 13.0. For further details of these reading materials see Appendix 'A'.

2. Problems in Reading

Only a small group of apprentices had serious difficulties with reading, the main problems being with understanding technical terminology. To overcome these difficulties teachers had to adopt a flexible approach in lessons, providing more opportunities for question and explanation, placing very little reliance on the printed word as a means of instruction.

3. Ways in which Difficulties were being Overcome

In the college surveyed, remedial classes in reading and mathematics provided assistance for students experiencing learning difficulties.

4. Ways in which Difficulties could be Overcome

Teachers interviewed felt that difficulties were being dealt with adequately.

5. *Writing in College Work*

Short answers to examination questions and class notes formed the bulk of the writing expected of apprentice carpenters and joiners at college. Teachers reported that the standard of written expression and spelling among apprentices was poor.

V. PAINTING AND DECORATING

RANGE OF THE TRADE

Painters in Queensland were found to work in a range of situations:-

- they were employed by large Government departments and worked both on new buildings and the maintenance and renovation of older buildings;
- they may work in private industry, either for themselves or for a small firm. They may be sub-contracted to a large building company to paint a particular complex;
- painters may also work in large industrial settings (for example, mining site or in a refinery) where contracts may run into many thousands of dollars and the amount required on a surface is measured in inches not in numbers of coats.

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of the trade).

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

Painters received both verbal and written instructions. On larger jobs, plans and colour charts supplied by the builders or architects had to be read and interpreted. As in most trades, the responsibility for reading these instructions belonged to the foreman; on the large Government site all plans and colour charts were kept in his room and read only by him, the tradesperson being told what to do. On smaller jobs, the tradesperson might read job specifications and builders plans, but he was usually told what to do either by his employer or the customer.

All apprentices were told what to do.

(b) *Detailed Written Instructions*

The only instructions mentioned by tradespeople were:-

- builders's plans, architect's drawings;
- memos from builders and architects (including photographs and diagrams);
- manufacturer's instructions.

The importance of reading these instructions varied, a foreman working for a Government department would refer to them several times a week and considered them vital to the completion of his task. The apprentices surveyed tended to ask their employer what to do before looking up any written instructions.

(c) *Problem Solving*

When a tradesperson or apprentice encountered a problem he was unlikely to read to find the answer.

Employers surveyed discouraged any initiative and felt tradespeople should go to the leading hand - "It's our money they are spending. We would prefer them to ring us for advice". When the leading-hand was asked whether he would use reference materials in the event of a problem, he replied that this was not necessary, he would find out what was wrong by trial and error, or if necessary call the manufacturer or supplier.

Manufacturers do however provide information which could be used to solve technical problems. See Appendix 'A'.

(d) *Reading with Customers*

Little reading was involved when the painter met with customers. The tradesperson working in a private home might occasionally be required to interpret written instructions or colour charts to customers. Although little reading was involved, the way in which the tradesperson approached the customer was crucial. As one employer put it, "their trade ability almost comes second. If the customer takes a look at him and likes him and accepts him, he's half way there". In Government departments, the customer (in this case the Government department requiring work done) was contacted by the consultant architect.

2. *Updating Knowledge*

The way in which tradespeople kept up-to-date with new developments in the trade seemed haphazard. The tradespeople working for a private firm might read a product information sheet when a customer requested a new product, whereas in the Government department decisions about new products were not usually the responsibility of tradespeople but of supervisors usually in the planning section. Should a leading hand be required to find out about a new product, he did so by contacting a representative from the company or by attending a trade night.

3. *Writing on the Job*

Little writing was required of the painter apart from filling in his time sheet although apprentice painters did in their log books. Writing identified consisted of notes of daily progress made on the job instruction sheet, memos written for the placing of orders, and invoices for incoming materials which had to be signed.

B. *LITERACY DEMANDS AT COLLEGE*

1. *Reading Materials Used at College*

Almost all the reading required of apprentice painters was contained in Painters and Decorators State notes prepared by the staff of the T.A.F.E. college surveyed. These were used daily and considered to be vital. In practical classes students were also required to read manufacturer's instructions and possibly data sheets from paint companies. There was no single satisfactory text book for the painting industry although there were a number of good journals to which teachers referred when writing up college notes. In future it was hoped that students might be referred to these journals.

2. *Problems in Reading*

Teachers reported that although the average Grade 10 students could cope with the required reading, some students did have problems with word meaning and their comprehension was likewise very poor. Only a small proportion had severe learning difficulties. Motivation to read instructions was low, as one teacher put it "students don't read them unless they have to". Teachers reported difficulties with teaching technical terminology - apprentices needed to know these terms - but teachers found difficulty in presenting them in an interesting manner.

3. *Ways in which these difficulties were being overcome*

Teachers provided tape recordings of notes for those with severe reading problems. Lessons were structured so as to include as many concrete examples as possible - to quote one teacher "to understand, these kids have to see, touch, feel and practically taste the naterial". Technical language had to be kept to a minimum. Remedial classes were available for those experiencing severe problems in the college surveyed.

4. *Ways in which these difficulties could be overcome*

Adequate measures were currently being undertaken to overcome these difficulties.

5. *Writing at College*

The bulk of the writing required of the apprentice at college was in their communications course - in this course the apprentice learned to write letters, complete banking forms and fill in various business forms. Apart from this little writing was required at college. Staff reported that the standards of writing was poor and for this reason the writing requirements of the course were kept to a minimum.

VI. COOKING

RANGE OF THE TRADE

Cooks in Queensland work in a range of situations:-

- a medium sized well reputed *á la carte* restaurant in Brisbane suburbs;
- a larger *á la carte* restaurant in Brisbane city;
- a large international standard hotel in Townsville;
- a resort restaurant also in the North of the State;
- a large catering firm; and
- a staff mess with a large mining company.

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of the trade).

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

Cooks received both verbal and written work instructions each day. In a large kitchen a menu was drawn up by the catering officer and the chief chef. This was circulated amongst the staff, and referred to several times a day, particular tasks being assigned verbally to cooks and apprentices. In a catering firm a cycle menu was used to which the chef and cooks referred daily. In a restaurant the chef knew his menu, and the apprentice was normally told what was required of him. In some establishments he was expected to note this down.

(b) *Detailed Job Instruction*

Cook books are available for reference in all kitchens, the extent to which they were referred to varied - most chefs stated that recipes were known by heart and cookbooks were only referred to when the menu was to be changed or in the event of a special function. Apprentices reported however, that they referred to them more frequently. Larger catering firms had staff manuals, stating the company's regulations, for example, on hygiene. In planning functions, cooks at large hotels were required to read revenue summary sheets so that a reasonable profit margin could be maintained. (See Appendix 'A').

(c) *Problem Solving*

In the event of a problem on the job cooks would consult any of the above mentioned job instructions. The first resort of most tradespeople and apprentices would be to ask the chef or another colleague for advice regarding the problem.

(d) *Reading with Customers*

Cooks were only occasionally involved in reading with customers. A chef in a small restaurant might have occasion to interpret the menu to customers and similarly when a customer was planning a large function, the chef may plan the menu with him.

2. *Updating Information*

Cooking journals (see Appendix 'A' for examples) magazines, new cookbooks even newspapers provided cooks with ample material to keep abreast of latest developments in the trade. Manufacturers also send trade information to cooks and held trade nights. The extent to which these were referred to varied - some chefs bought all the cookbooks that came onto the market - others were not concerned with recent trends and developments.

The reading level of the above materials ranged from 9.4 to 12.4 . For further details see Appendix 'A'.

3. *Writing on the Job*

Ordering in stock (usually this simply involved filling in a form) comprised the major part of any writing a cook needed to do on the job. Menu writing was also required of the chef - the frequency with which he did this varied according to the nature of his establishment. A cook in charge of a large canteen would probably write a daily menu whereas a chef in an *à la carte* restaurant would change the menu only once every few months. Cooks who worked for a large firm were required to write reports or estimates for particular functions or services. Some apprentices kept notes on various aspects of their kitchen and the particular tasks they were to perform each day.

B. *LITERACY DEMANDS AT COLLEGE*

1. *Reading Materials used at College*

During their college studies apprentices were required to read their text books daily (usually when cooking in practical classes). Notes and handouts prepared by the college were also read daily. Both these kinds of reading were considered vital. Apprentices were encouraged to read trade journals several times a week, this was considered supplementary rather than vital.

2. *Problems in Reading*

The teachers surveyed had all encountered students who had problems with the reading required for the course. A small group of students (five percent) experienced severe reading problems - teachers reported that these students did not know how to read at all. A larger group lacked comprehension skills which lead to production of poor quality dishes. While their text *Professional Practical Cookery* covered all aspects of the cooking process in the manner one would expect of a professional manual, apprentices were often unable to use it to best advantage. They reported confusion over the layout of recipes (the extensive use of cross referencing in particular), and the use of french culinary terminology. Language was technical and trade specific, a cook may be instructed to 'gratinate' under the 'salamander' or 'melt in a sauteuse and add the spetzli'. Certainly a student could look up these terms in the index of glossary[1] but considering these terms, using cross references as well as cooking and preparing the meal presented problems of organization even for the best students. Teachers commented that this inability of students to organize their thinking, materials and work was the major problem which they encounter with students.

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[1] Although some terms, for example, 'spetzli' are not defined.

3. *Ways in which these difficults were being overcome*

To overcome these difficulties teachers tried to make their lessons as concrete as possible using as many visual prompts as they could. This was difficult with classes of twenty-eight students. Basic French cassettes were provided for first year students experiencing difficulty with terminology. Students with severe reading problems were given remedial classes by college staff (at that stage, no trained remedial teacher was available).

4. *Ways in which difficulties could be overcome*

(a) *Better Selection*

Teachers felt that many of the problems could be overcome if apprentices were selected with more care, school reports were no indication of an apprentice's level of basic skills. A screening test of literacy and numeracy skills would assist employers in selection.

(b) *On the Job Training*

More on the job training would improve the standard of some apprentices. Teachers reported a wide range of standards among apprentices - some had clearly been taught skills on the job - others had been used as cheap labour only.

(c) *Longer Blocks, Smaller Classes*

Longer blocks could help improve standards. Two seven week blocks were not long enough to teach apprentices all the culinary skills they needed to become professional chefs. Classes of twenty-eight apprentices were felt to be too large for the teacher to work effectively in the theory and practice of this subject.

3

5. *Writing in College Work*

Varying amounts of writing were required by different teachers. Notes, assignments, menus and kitchen plans were all required. Students were also encouraged to write work plans - with time allowances for each phase of work. In practical examinations they were required to do this before commencing cooking.

VII. HAIRDRESSING

RANGE OF THE TRADE

In order to gain an overview of the literacy and numeracy requirements of the hairdressing industry tradespeople working in a variety of situations were interviewed:

- small suburban salons with one or two senior hairdressers and one apprentice;
- an inner city arcade salon operated by the owner with one apprentice;
- a small but well established chain of hairdressers with two city salons;
- a large hairdressing firm with salons all over Queensland (staff from Brisbane and Townsville).

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of the trade).

A. LITERACY ON THE JOB

1. Job Performance

(a) Job Allocation

Hairdressers usually relied on verbal instructions from customers, they would also be required to read the appointment books, notes and memos, (this would involve learning the salon's abbreviations for standard services). Interpreting verbal instructions from customers required considerable tact and maturity.

However, to find out what a customer really wanted the hairdresser needed to be aware of the kind of person that she was dealing with (both their appearance and their body language) , she must be prepared to listen, ask questions and make suggestions.

(b) Detailed Job Instructions

Detailed job instructions were available for the hairdresser. Tradespeople referred to them infrequently and considered them to be supplementary rather than vital. Apprentices referred to instructions more frequently and considered them to be more important than the tradespeople did.

- Manufacturer's Instructions/Service Updates

  Manufacturer's instructions were available in the form of trade manuals or information sheets which came with new products or the instructions on the packages (Document VII(c)) Although these were available to tradespeople and employers the extent to which they were used varied, one hairdresser occasionally referred to them when a new product comes in but she would be just as likely to get the same information from a 'trade night'. Another said that instructions were vital, that they were used two-three times a day and should be followed implicitly. Apprentices reported that they read instructions until they had learned them. One girl reported difficulty with understanding directions and found charts for mixing very confusing. This may be one reason why one employer reported that the girls avoid reading instructions 'at all costs'.

- Journal Articles

Fashion and hair magazines were read by all sections of the trade; apprentices in particular reported reading these frequently.

- Text Books

Apprentices reported referring to their text books two or three times a week.

(c) *Problem Solving*

When a problem arose the hairdresser would either look up the manufacturer's recommendations or ask another colleague. Most of the apprentices would ask a senior for help when they ran into difficulties rather than go to the books. The emphasis on seeking out information verbally was reflected even in trade literature 'technical advice is as close as your telephone' read a brochure from one leading manufacturer (see Appendix A.) Reading to solve problems seemed to be a last resort, as one senior hairdresser put it "if all else fails, read the instructions".

(d) *Reading with Customers*

Hairdressers were frequently involved with interpreting illustrations or diagrams (of a particular style or haircut) to customers. They may also be required to interpret manufacturer's instructions (for example, the use of a particular product to customers).

2. *Updating Information*

Keeping abreast of latest developments in the trade was of utmost importance in the hairdressing business. This was done by reading trade journals or by attending trade seminars, product information nights and hairdressing competitions. One large firm used video to keep staff up-to-date with latest trends, managers from regional centres flew to Brisbane regularly to attend staff meetings.

3. *Writing on the Job*

The writing required by the hairdressing trade was not extensive although the employer in one large firm considered it to be more important than the reading required of the tradesperson. Tradespeople were required to fill in time cards and dockets. Appointment books must be filled in, correct spelling (for example, client's names) and neatness were essential if accurate orders were to be taken. It was also important to know the standard abbreviations for the different services. Supervisors had extensive paper work and correspondence to complete each week. A number of employers ran staff development programs and these usually involved some writing. One employer required apprentices to give a small paper on some aspect of hairdressing each week. This company also had a well developed self-monitoring system whereby tradespeople were required to record what they did each day and to set work performance goals for themselves.

B. *LITERACY DEMANDS AT COLLEGE*

1. *Reading Materials Used at College*

During their college studies apprentice hairdressers were required to read notes written by T.A.F.E. staff daily. Two text books were set - one on the theory of hairdressing, the other on the practice of it. These were read several times a week. Trade literature in the form of manuals and brochures was also required reading in both theory and practical classes. Students were also required to read trade journals for assignment work.

The reading level (estimated using the FORCAST formula) of the materials used in the college work of hairdressers ranged from Grade 9.3 to Grade 13.0. For further details of these reading materials see Appendix 'A'.

2. *Problems in Reading*

The degree to which students encountered problems with this reading varied. Some teachers stated that the difficulties were so serious that they had to rewrite the text book for students. Students had difficulty with word-meaning and examination questions had to be worded in the simplest language possible. Occasionally literacy was so poor that a student had to be given oral examinations. When questioned as to how many students encountered these difficulties, estimates varied with several teachers saying that only two or three experienced difficulty and other teachers saying that half the class were having difficulty.

3. *Ways in which these difficulties are being overcome*

As previously mentioned teachers were required to rewrite notes and examination papers in the simplest possible language. A remedial teacher based at the college worked with students who were found to be experiencing difficulties.

4. *Ways in which these difficulties could be overcome*

The remediation currently offered was seen as sufficient.

5. *Writing in College Work*

Apprentices were required to write class notes, essays and projects. Different types of writing were required:-

- comparing and contrasting different processes;
- describing cause and effect;
- outlining processes in a step-by-step sequence.

Teachers reported that the standard of writing was poor and the handwriting often illegible.

VIII. PLUMBING AND DRAINING

RANGE OF THE TRADE

Plumbers and drainers work throughout Queensland in a wide variety of work situations. As one plumber put it:

> *"wherever there is water to be installed, you will find a plumber".*

Thus, plumbers may work in:

- Government departments installing plumbing systems in Government complexes and inspecting plumbing systems to ensure that they conform with regulations;
- large building firms installing plumbing systems throughout the firm's sites;
- large plumbing contractors installing plumbing on new sites;
- plumbers may also work for themselves or with a company on the repair and maintenance of cottage plumbing.

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of the trade).

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

In the plumbing trade, tradespersons were usually told what they had to do each day by the leading-hand or foreman. These verbal instructions were, in some cases, supplemented by a written job card or a set of plumbing and drainage plans.

(b) *Detailed Job Instruction*

In the course of his daily work the plumber could be called on to read:

- Manufacturer's Instructions

  (For example, in cottage work, regarding the installation of garbage disposal units, or on large building sites, tolerances and specifications for piping);

- Standard Sewerage By-Laws

  (A new set of these has recently been issued and is, as yet, still not widely available). These cause considerable problems for older tradespeople accustomed to the old laws;

- Plumbing/Drainage Plans and Builders Specifications and Plans

  (These would be required with work on any new site. In order to read them the plumber would need to be familiar with the *Australian Standard's Association* abbreviations).

Although the plumber needed to be able to read all these materials, the frequency with which he would be required to read them varied according to the type of job he was working on. Most often it was the foreman who was responsible for reading plans, specifications and by-laws.

(c) *Problem Solving*

Although tradespeople could consult by-laws and manufacturer's instructions in the event of a problem, all those interviewed stated that their first course of action would be to telephone the person supervising the work, although in some work situations tradespeople are encouraged by management to *ask* rather than solve problems on their own (for example, most Queensland Government plans and drawings state clearly, in large print

"DO NOT SCALE. WHEN IN DOUBT, ASK".

The usual reason for phoning for information rather than reading for it, was simply because it was easier to ask.

(d) *Reading with Customers*

None of the plumbers interviewed in this sample were required to interpret reading material to customers.

2. *Updating Knowledge*

The plumbers interviewed were not generally concerned with updating their knowledge on latest developments in the trade. Manufacturers did put out brochures; these would be read only if the installation of a new system or appliance required it. In larger firms information about new products and technology was the concern of the management rather than the individual tradesperson (management may read publications from the Master Plumbers Association, these were not available to the average plumber who belonged to a union).

3. *Writing in the Workplace*

The amount of writing required of the plumber varied across work situations; some plumbers were expected to write detailed work descriptions for costing purposes. Some were required to order in materials, this involved filling in requisition forms. In some work situations, larger establishments in particular, these writing tasks tended to be the responsibility of the foreman or leading-hand plumber.

B. *LITERACY DEMANDS AT COLLEGE*

1. *Reading Materials Used at College*

During their college studies apprentice plumbers were required to read college notes, trade manuals and standards and specifications (usually in the form of by-laws and publications from the Australian Standards Association) daily. The reading was considered essential and involved extensive use of indices and an understanding of the layout of the sections in the book.

The reading levels of these materials ranged from Grade 10.0 to Grade 13.0. For further details of these reading materials see Appendix 'A'.

2. *Problems in Reading*

Teachers of plumbing reported that some students did experience difficulty with comprehending written materials, particularly the standards and specifications contained in by-laws (for example, *Standard Sewerage By-Laws)*. Although difficulties were experienced with technical terms, students also had problems with basic terminology, for example, words like 'preferred' and 'appliance'. Teachers reported that although the average student did have some difficulty with reading, only three or four out of a class of twenty-eight experienced reading problems which severely hampered their trade studies.

3. *Ways in which these difficulties were being overcome*

Tutorial classes were provided for those experiencing severe reading problems, most lectures were available to students on cassettes, teachers reported that students were often able to cope more easily with orally presented lectures than with the written word.

4. *Ways in which these difficulties could be overcome*

College staff believed that a more stringent approach to the selection of apprentices would obviate many of these difficulties. Plumbing is currently rated as a 'B' class trade requiring the applicant to have passed Grade Nine before entering the trade. Teachers felt that this was an inadequate entry level for a licensed trade in which the tradesman was expected to take responsibility for the health of large numbers of the population.

5. *Was there a need for teachers to be trained to teach students the special reading skills needed in this subject area?*

Teachers did not see a need for training in these skills; they felt they knew enough to teach in these subject areas, as they put it: "They were 'survivors' and experience had taught them what they needed to know."

6. *Writing in College Work*

Writing was an important component of the apprentice plumbing course. After each class, apprentices were required to complete short answer questions on the work covered in that class. Apprentices were also required to complete written projects during each block. Examination questions were also required to be completed with short answers.

Staff reported that many students had difficulty with this writing. Spelling was poor and the use of vocabulary and sentence structure made meaning difficult to decipher.

IX. BOILERMAKING

RANGE OF THE TRADE

Boilermakers are employed across a wide range of work situations in both the fabrication and maintenance of steel constructions using plate which is 1/8th" thick and over (according to union regulations those working in metal under 1/8th" thick are classed as sheet metal workers). Thus, boilermakers may be found in:

- shipyards repairing and constructing steel ships;
- large engineering shops;
- mining sites,
  (in construction and maintenance of equipment);
- Government departments,
  (for example, Main Roads Department).

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of the trade).

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

In most work situations boilermakers were allocated the work they had to do each day verbally (usually the foreman would allocate work to tradespeople). This was usually accompanied by a drawing of the work to be completed. In some work situations written instructions (for example, Production Cards from the Planning Office) were issued each day. When asked why verbal instructions were issued rather than written instructions, works' managers stated that verbal instructions were the most straight forward allowing the manager flexibility to change and re-allocate work when necessary.

(b) *Detailed Job Instruction*

The most frequently referred to detailed job instruction for the boilermaker was the technical drawing which gave dimensions and specifications for the product to be made. In most workshops such drawings were visible on almost every workbench, open, well-worn and constantly being referred to. Other instructions referred to were manufacturer's instructions (for example, regarding different welding gasses) and *The Australian Standards* for the welding requirements of different structures. The foreman rather than the average tradesperson would be responsible for reading these last two forms of job instruction.

(c) Problem Solving

When a problem arose on-the-job most tradespeople would look again to their drawings, if the solution was not apparent they would then ask the foreman or leading-hand for advice. In some companies tradespeople were encouraged to seek the advice of the leading-hand rather than to try to solve the problem themselves. As one work's manager put it:

> "We pay boilermakers to be boilermakers and leading-hands to be leading-hands ... if the boilermaker makes a 'blue', it's finished".

In other work situations individual problem solving is encouraged, for example, in one Government Department surveyed, a systematic five step problem solving system was taught in their training school. (It is interesting to note that despite this, all this department's drawings state

"DO NOT SCALE. IF IN DOUBT, ASK".)

(d) Reading with Customers

None of the boilermakers surveyed were responsible for interpreting written materials to customers.

2. *Updating Knowledge*

The boilermakers surveyed did not have any systematic method of keeping up-to-date with the latest developments in their trade. As new materials came into the workplace (for example, new types of welding rods) they would get information from representatives of the manufacturers, depending on the interest of the individual tradesperson. This information would be read or discarded.

3. *Writing on the Job*

Only one of the boilermakers surveyed had significant writing requirements placed on him by his job - he was required to fill in forms and give a brief job description of the work he completed. Any writing required on the other job sites surveyed was the responsibility of the foreman.

B. *LITERACY DEMANDS AT COLLEGE*

1. *Reading Materials Used at College*

There was no standard text in boilermaking, apprentices worked almost entirely from college notes. Occasionally, they were required to refer to *The Australian Standards* (for example, in the types of welding required for certain constructions).

The reading levels of these materials ranged from Grade 10.6 to Grade 12.0. For further details see Appendix 'A'.

2. *Problems in Reading*

Boilermaking apprentices experienced difficulty in extracting and comprehending written material in notes. They also had difficulty understanding technical terms and definitions. However, only a small proportion of the class experienced difficulties severe enough to hamper their trade studies.

3. *Ways in which these difficulties were being overcome*

Remedial tutorial classes were provided for those experiencing reading difficulties and in isolated cases students were given oral examinations.

4. *Ways in which these difficulties could be overcome*

One boilermaking teacher suggested that more tutorial classes needed to be provided.

5. *Was there a need for teachers to be trained to teach students the special reading skills needed in this subject area?*

Boilermaking teachers' response to this question was that they had no need for such training, students needed to be better prepared by schools (both at a secondary and a primary level).

6. *Writing in College Work*

Most forms of assessment for the apprentice boilermaker involved some writing - either short answer or short essays. Apprentices were also required to take dictated notes.

Teachers reported their dismay at the standard of apprentices' writing - some apprentices were unable to fill in simple enrolment forms.

X. FITTING (DIESEL AND HEAVY EARTH MOVING EQUIPMENT)

RANGE OF THE TRADE

Fitting (diesel and heavy earth moving equipment) is a rapidly expanding trade in Queensland. Diesel fitters work on the repair and maintenance of motors, engines and vehicles in:

- Government Agencies (for example, Main Roads Department and the Forestry Department);
- Agencies for heavy earth moving equipment;
- Large mining sites where large heavy earth moving equipment is in constant use;
- in smaller earth moving contractors where they are responsible for the maintenance of all vehicles.

(These examples were obtained from the sample interviewed and are not meant to be a definitive list of the trade).

A. *LITERACY ON THE JOB*

1. *Job Performance*

(a) *Job Allocation*

Diesel fitters received both verbal and written job instructions. Verbal instruction was the most usual manner of job allocation. Some firms relied almost entirely on the foreman to inform the tradesperson verbally of what he had to do. In smaller firms the tradesperson would be allocated work via a two-way radio. Written instruction usually came in the form of job cards or on large sites (where the records of work and job allocation were held on computer) computer print-out. Where work was allocated from visual display units the foreman usually had responsibility for relaying this information onto tradesmen.

(b) *Detailed Job Instruction*

Diesel fitters relied heavily on detailed job instruction in order to complete jobs (See Table 2). Trade manuals and manufacturer's instructions were considered essential by most diesel fitters. Charts of settings and specifications were referred to daily in repair and maintenance work and in the identification of parts for requisition. In some firms parts lists and even service bulletins are held on microfiche. Reading demands were greatest when a new vehicle came into the workshop and tradesmen had to become familiar with manufacturer's recommendations and specifications. This would often involve reading technical drawings, for example, wiring diagrams or exploded views of a particular section. The reading demands for the tradesperson and the apprentice were very similar in this trade.

(c) *Problem Solving*

When a problem arose on the job a diesel fitter would be able to refer to any of the above mentioned detailed job instructions. Most manuals contained extensive trouble shooting charts. He would, however, usually seek advice verbally either from the foreman, the operator of the vehicle or the manufacturer. Large international companies often had well indexed technical information systems which aimed to give tradespeople the most up-to-date information.

(d) *Reading with Customers*

Occasionally the diesel fitter may be called on to interpret an operator's manual to an operator, however, this was a rare occurrence.

3. *Updating Knowledge*

The trade of diesel fitting is rapidly changing. If the tradesperson is working in an area where he is frequently faced with new equipment, in order to remain competent, he must continually update his knowledge of the trade. The tradesperson usually did this by reading service manuals of new vehicles as they came in - some companies provide service magazines detailing latest developments in the trade, these were issued to each section and most tradespeople would at least peruse them. A number of magazines and journals in the area of heavy diesel and earth moving equipment such as:

The Earth Mover and Civil Contractor,
The Resources Journal,
Crane Australia.

are available and some tradespeople, particularly those working for smaller businesses, would keep abreast of developments in the trade by reading these.

The reading level of the above materials ranged from 9.8 to 15.0. For further details see Appendix 'A'.

4. *Writing on the Job*

The writing required of the diesel fitter was quite extensive, and although in some establishments the responsibility for writing rested largely with the foreman, the tradesperson was still expected to write detailed job 'stories' on work he completed. These 'stories' were required to be detailed and accurate as the cost of the work done was estimated from these reports. In one international company all reports were analysed by computer and their service magazines were based on findings from these reports, hence the need for accurate, careful reports.

Most foremen and workshop managers reported some dissatisfaction with the standard of these reports; in some cases spelling and expression were poor, in others, the amount of accurate detail of procedures performed was insufficient.

B. LITERACY DEMANDS AT COLLEGE

1. *Reading Materials Used at College*

Quite extensive reading was required of the diesel fitter at college:

- trade manuals;
- two set text books; and
- college notes;

were read daily and considered to be vital. The reading levels of these materials ranged from 10.0 to 12.6. For further details see Appendix 'A'.

2. *Problems in Reading*

Only a small proportion of the class experienced reading difficulties severe enough to seriously hamper their trade studies. However, most of the class did have some problems:

(a) locating the correct manual for the model of diesel engine on which they were working; and

(b) locating relevant information within that book (the identifying code for some engines could be up to eight or nine digits).

3. *Ways in which these difficulties were being overcome*

Tutorial classes were provided for those students experiencing severe reading difficulties. Activities and exercises designed to teach apprentices how to locate and use information in service manuals were built into the course. Apprentices were also taught basic problem solving and trouble shooting techniques.

4. *Ways in which these difficulties could be overcome*

At present much remedial work was rendered ineffective by the seven week block system, any basic skills which the student learnt during his first block were usually lost by the time he returned twelve months later for his second block. To be effective, some means of continuing remediation throughout the apprenticeship period is needed.

Closer attention to the selection of apprentices was required to ensure that those entering the trade had the basic educational skills required to cope with the demands of college work. The trade is technically complex and changing rapidly, teachers are hard pressed to cover all material in their seven weeks, they have little time to teach basic skills.

It was suggested that *trade specific* entry tests may be of some assistance in selecting the most suitable applicants.

5. *Was there a need for teachers to be trained to teach students the special reading skills needed in this subject area?*

No, teachers felt that their expertise in this area was quite adequate.

6. *Writing in college work*

Apprentice diesel fitters were required to perform a range of writing activities from assignment work (typically involving a two or three line answer) to writing out the specifications for work on a particular vehicle, writing service and warranty reports and filling in requisition sheets when ordering parts. Teachers reported that the standard of writing was poor and that inaccuracy of expression often made reports hard to follow.

C. CHARACTERISTICS OF READING MATERIALS COLLECTED: DISCUSSION

Fifty-four samples of reading materials were collected during the study. Of these, thirty-six were used 'on-the-job' and twenty were used by apprentices at T.A.F.E. colleges. This sample is not presented as wholly representative of any of the trades studied but does serve to illustrate the type of material and reading required in each trade.

The materials collected have been categorised in terms of:

(a) Readability (FORCAST formula, Sticht, 1970);

(b) Purpose for which intended;

(c) Content-type category (Sticht, 1970).

NOTE: The category 'Technical Drawing' was added to Sticht's list of categories. See Table 10.

(a) *Readability (FORCAST formula)*

The mean readability scores for 'on-the-job' and 'college' materials are shown in the following table. (Table 9.) No correlation is shown between the difficulty of the trade, as suggested by the Industry and Commerce Training Commission trade classifications, and the difficulty of the print resources provided. That is, Class C trade materials have just as high a readability level as Class A or Class B trades. In some cases, however, there does appear to be a significant difference in favour of 'college' when compared with 'on-the-job' materials. Where possible, ten samples were measured from each print resource and these results averaged to obtain a figure for the text as a whole. Appendix 'D' shows the sampling procedure used.

TABLE 9.

MEAN READABILITY SCORES BY TRADE

TRADE	MEAN READABILITY		TRADE CLASSIFICATION
	JOB	COLLEGE	
I. Electrical Fitter/Mechanic	11.6	11.1	A
II. Fitter/Machinist	10.8	10.8	A
III. Motor Mechanic	11.8	10.7	B
IV. Carpenter and Joiner	11.3	10.0	B
V. Painter and Decorator	12.0	9.2	C
VI. Cook	10.9	11.6	C
VII. Hairdresser	-	11.3	C
VIII. Plumber	12.2	11.3	B
IX. Boilermaker	10.6	10.8	B
X. Fitter (Diesel and Heavy Earth Moving)	12.4	10.9	A

(b) *Purpose for which Intended*

Of the thirty-six 'on-the-job' reading samples collected, twenty-one were categorised as 'Detailed Job Instructions', seven as 'Updating Knowledge', three as 'Job Allocation' and three as 'Problem Solving'.

These materials were gathered as examples of reading which was carried out in order to function effectively in the particular trades. It should again be pointed out that the list is not meant to be a comprehensive catalogue of all materials used and only very limited conclusions may therefore be drawn.

As might have been expected, the overwhelming proportion of the materials were devoted to 'how-to-do' various tasks associated with the respective trades. In contrast, relatively few samples (three) were obtained of reading associated with job allocation. This inbalance supports the researchers' observations that in the vast majority of cases, job instructions are given verbally rather than in writing.

(c) *Content-type Category (Sticht, 1970)*

Sticht's content-type categories (see review of literature) were used to distinguish between the different reading samples collected. Where possible, the material was placed into only one category, although in several instances this did not appear advisable as the material appeared to contain a number of different characteristics. In addition, note must also be made of the large number of materials which contained examples of highly complex technical drawings. These involved,

- . electrical circuit diagrams,
    - electrical fitter/mechanic,
    - motor mechanic,
    - diesel fitter.

- . engineering drawings,
    - fitter/machinist,
    - motor mechanic,
    - boilermaker,
    - diesel fitter.

- . building drawings,
    - carpenter and joiner,
    - painter and decorator,
    - plumber.
- . biological diagrams,
    - hairdressers

- line and photographic illustrations,
    - hairdressers,
    - cooks.

It can, therefore, be seen that in addition to any difficulties presented by the prose elements of the print materials, all apprentices had also to contend with graphical information, much of which was at an extremely complex and abstract level. Table 10 which follows summarises the points made above.

TABLE 10.

TRADE Document Number	Readability Estimate*	Purpose	CONTENT-TYPE CATEGORIES (from Sticht, 1970)					
			Procedural directions	Functional description	Theory	Identification code	Standards Specifications	Procedural checklist
I. ELECTRICAL FITTER MECHANIC								
Literacy on the Job								
Document I(a)	-	Job allocation		✓		✓		
I(b)	11.8	Detailed job instruction					✓	
I(c)	-	Detailed job instruction						
I(d)	10.9	Detailed job instruction		✓				
I(e)	-	Problem solving						
I(f)	-	Problem solving						
Literacy at College								
I(g)	11.5	Textbook			✓			
I(h)	11.8	Textbook			✓			
I(i)	10.1	College notes			✓		✓	
II. FITTER/MACHINIST								
Literacy on the Job								
Document II(a)	-	Detailed job instruction						
II(b)	11.3	Updating information	✓				✓	
II(c)	-	Detailed job instructions					✓	
II(d)	10.4	Detailed job instructions	✓		✓			
II(e)	-	Updating information					✓	
Literacy at College								
II(f)	10.9	College notes		✓	✓		✓	
II(g)	10.7	Textbook	✓	✓	✓	✓		
III. MOTOR MECHANIC								
Literacy on the Job								
Document III(b)	13.5	Updating information					✓	
III(c)	12.7	Updating information	✓				✓	
III(d)	11.5	Detailed job instructions	✓				✓	
III(e)	9.6	Detailed job instructions	✓				✓	
III(f)	12.0	Detailed job instructions	✓					
Literacy at College								
III(g)	10.5	Textbook	✓		✓			
III(h)	10.8	College notes	✓		✓			
III(i)	-	Study exercises			✓			
IV. CARPENTER AND JOINER								
Literacy on the Job								
Document IV(a)	-	Detailed job instructions					✓	
IV(b)	13.0	Updating information		✓			✓	
IV(c)	12.0	Detailed job instructions					✓	
IV(d)	10.8	Detailed job instructions	✓		✓			
IV(e)	11.0	Detailed job instructions					✓	
IV(f)	9.9	Detailed job instructions					✓	
Literacy at College								
IV(g)	10.1	College notes	✓		✓		✓	
V. PAINTER AND DECORATOR								
Literacy on the Job								
Document V(a)	13.5	Detailed job instruction					✓	
V(b)	10.5	Problem solving	✓				✓	
Literacy at College								
V(c)	9.2	College notes	✓		✓		✓	
VI. COOK								
Literacy on the Job								
Document VI(a)	-	Job allocation		✓				
VI(b)	-	Job allocation		✓				
VI(c)	-	Revenue summary						
VI(d)	12.4	Trade manual			✓			✓
VI(d)	9.5	Detailed job instructions	✓					
Literacy at College								
VI(e)	11.6	College notes	✓		✓		✓	
VII. HAIRDRESSER								
Literacy on the Job								
Document VII(a)	-	Detailed job instructions	✓					
Literacy at College								
VII(b)	12.4	College notes	✓		✓			
VII(c)	10.8	Textbook	✓		✓			
VII(d)	10.8	Textbook	✓		✓			

Use of the Sticht 'content-type categories' does not appear to have greatly assisted in the assessment of the reading materials collected. It would appear that these might usefully be revised as follows:

1. Basic Theory

   This category would include all explanations of the principles on which a technique or trade was based. For example, in Hairdressing, the study of the biological nature of the hair, in Electrical Fitting, the study of electricity.

2. Applied Theory

   The study of how Basic Theories are applied in the trade context. Motor mechanics would thus consider the braking system as an application of faces and friction. The emphasis would here be on 'how' things work.

3. Standards and Specifications

   The technical criteria by which trade practices are set and carried out.

4. Job Directions

   Specific directions on how to carry out a particular task. For example, in Boilermaking, how to weld and/or assemble a specific component; in Carpentry and Joinery, how to construct a particular wooden frame.

Since all types of materials were found to involve technical drawings, tabular information and prose passages, it seems desirable to move towards a matrix analysis where materials might be categorised in terms of their content-type (as above) and also their content-characteristics. The resulting profile would then be displayed as follows.

EXAMPLE:

DOCUMENT 1(b) *Australian Standard 3,000. Part 1. S.A.A. Wiring Rules*

CONTENT - TYPE				
CONTENT CHARACTERISTICS	BASIC THEORY	APPLIED THEORY	STANDARD SPECIFICATIONS	JOB DIRECTIONS
Technical Drawings				
Tabular Information			✓	
Prose Description			✓	

Use of such an analysis on a broader spectrum of trade materials than assessed in this pilot study would allow a clearer description of the literacy demands in each trade.

Notwithstanding the foregoing, it appears that sufficient data has already been assembled to give teachers, in both secondary and technical education, a clear indication of the literacy demands placed on apprentices in the trades studied. It would appear that both groups should be able, on the basis of this evidence, to assess their own courses in terms of their contribution to the development of appropriate literacy skills in persons interested or engaged in the apprenticeships described.

NUMERACY DEMANDS AT WORK AND COLLEGE IN THE TEN TRADES

(See 2.12 for Summary)

I. ELECTRICAL FITTING AND MECHANICS

A. NUMERACY DEMANDS IN THE WORKPLACE

As can be seen in Appendix 'C', Table 11., electrical fitter mechanics state that considerable mathematics was involved in their trade. In order to complete almost any aspect of their trade the electrical fitter mechanic must however be able to interpret graphically presented information, (for example, graphs monitoring the performance of a lift, tables of figures in the back of the *S.S.A. Wiring Book* or circuit diagrams). The classification of literacy and numeracy overlap at this point. Thus, the interpretation of graphs, tables of figures and technical drawings is discussed in both sections. Specific numeracy requirements of the trade will now be discussed.

1. *Computations*

Mental arithmetic and the four arithmetic processes, addition, subtraction, multiplication and division were used frequently by the tradesperson; an electricity generating board tradesperson used it to calculate coil rewinds, or in calculating the distance between poles. A contractor used it to calculate maximum demands for size of cable. In some cases a calculator would have been used but a facility with hand and mental calculations was necessary for quick estimation of measurements and for checking the accuracy of calculations.

2. *Measurement*

Length was constantly referred to in the electrical trade (for example, cable size, length of bolts and brackets). This was more often an estimation of length rather than a direct measurement. Fine measurements were also required; for example, in calculating the size of bearings and clearances where a vernier or micrometer was used.

The calculation of volume, area and weight was used less frequently. Occasionally the tradesperson needed to know the volume of oil in a transformer but would have been more likely to estimate this than calculate it. A general appreciation of the concept of area was required. Formulae for area was used for calculating the cross sectional areas for cables. Weight needed to be considered in a number of situations, for example, the estimation of weight, the understanding of weight tolerances in manuals, as well as direct measurement of weight. As estimation of the weight of equipment was necessary for safety reasons, when moving equipment, installing new equipment, or the weight of equipment to go on a panel. Weight also needed to be estimated when two surfaces were to be joined with epoxy glue. Lift mechanics used the concept of weight in estimating overload and the appliance electrician considers charges in the gas in refrigerators in terms of weight.

3. *Imperial Measures*

In some areas of the electrical trade it was still necessary to think both in metric and Imperial measures and to convert from one to another where necessary. In the transformer workshop, for example, wire size may be Imperial but must be wired into a metric system. This involved quick mental calculation or reference to conversion charts.

4. *Fractions and Decimals*

A basic understanding of fractions and decimals was fundamental to most aspects of the electrical trade, for example, in electrical formulae and measurement.

Verniers and micrometers were calibrated in either fractions or decimals. The sizes of bearings, nuts and bolts were stated in fractions or in decimals. Conversion of fractions to decimals was occasionally required when instruments were calibrated in Imperial and specifications stated in metric.

5. *Ratio*

A general understanding of the concept of ratio was essential in some sections of the electrical trade. The electrician working in the transformer workshop referred to the ratio of voltage in and voltage out each day. An electrician in a large refinery needed to consider gear and velocity ratio several times a week.

6. *Percentages*

Percentages were considered essential in some sections of the trade for calculating resistance, in using some calibrating instruments and in pricing.

7. *Statistics*

Calculating a mean was the closest electrical fitter mechanics came to statistics and even this was done only occasionally.

8. *Tolerances*

The electrical fitter mechanic was required to think in terms of tolerances, calculating percentages of tolerances on relays and voltage drops in cables. Electrical fitters used tolerances when calculating bearing fit in the repair of motors.

9. *Interpretation of Tables of Figures and Graphs*

The interpretation of tables of figures was considered to be vital by all tradespeople surveyed although only one out of the six apprentices interviewed considered it to be vital. Among the kinds of tables listed were winding rates for transformers, machine settings, metric conversion charts, and the *S.A.A. Wiring Rules*. The interpretation of graphs was not as important as that of tables; graphs tended to be read only occasionally. Examples include graphs of torque/speed curves, and those showing rates of lifts.

10. *Estimation of Error/Length/Area*

As mentioned earlier in the section on measurement, estimation of length was as essential for the electrician as his other accurate forms of measurement. Cable-size area and bolt sizes, for example, were all estimated in length.

11. *Estimation of Error/Figures/Money*

Only one tradesperson mentioned this as a useful skill - he would use it when estimating the cost of a particular job and in determining whether a job was worth fixing.

12. *Interpretation of Technical Drawings*

This was considered vital by all tradespeople and most of the apprentices interviewed. Most technical manuals contain circuit wiring diagrams and these were constantly referred to by electrical fitter mechanics in repair and maintenance jobs in trouble shooting. Schematic diagrams were often worked through. Orthographic projections may also be used in repair work; these were often accompanied by a drawing.

13. *Geometry, Trigonometry and Algebra/Transformation of Formulae*

Geometry, trigonometry and algebra, the traditional preserve of secondary school mathematics, were used to varying extent by electricians. Geometry and an appreciation of size, shape, and angle was used more often by tradespeople particularly in bench work when, for example, constructing something out of steel. In larger factories, with the introduction of electronically controlled lathes, such knowledge becomes less essential.

Trigonometry was used only occasionally by the electrical fitter mechanic to calculate power factors; it was also used in interpreting waves and calculating angles between voltage and currents.

An understanding of algebraic formulae was needed in the electrical trade; Ohm's law was referred to by most employers and tradespeople interviewed. In most cases, geometry, trigonometry and algebra tended to be background information rather than something which is constantly referred to.

14. *Speeds*

These were used frequently in the workplace both by the tradesperson and the apprentice. Speeds must be taken into account when testing motor rewinds, setting motors and in setting up tools; for example, drill speeds.

B. NUMERACY DEMANDS AT COLLEGE

As can be seen in Appendix 'C', Table 11 the mathematics expected of the apprentice electrician at college is extensive. All of the mathematical operations discussed in the previous section on the numerical requirements of the job were seen as 'essential' to the completion of college work. Whereas the electrician in the work place was required to have an understanding of these mathematical operations, this tended to be regarded as background information. At college these mathematical operations were in use daily. This was reflected in the data collected from apprentices; volume, weight, angles, geometry, trigonometry and algebra considered necessary at college were not as important on the job.

1. *Computation*

Mental arithmetic and the four arithmetic processes were in constant use among electrical fitter mechanic apprentices at college: for example, the apprentice must know how to calculate voltage and distances. This involves applying algebraic formulae followed by computation; for example, Ohm's Law, $V = IR$, or addition of resistance in series $R = R_1 + R_2$. In most cases the apprentice would use his calculator for computation; as one teacher put it, "if the batteries go flat they've had it". The ability to estimate the correct answer was obviously an advantage.

2. *Measurement*

An understanding of length and an ability to estimate was vital in the workshop sessions where, for example, blue prints were used and in theory, for example, where the resistance of a conductor was proportional to its length.

Students needed to be able to calculate area, for example, cross sectional areas of conductors in relation to resistance and volume. Consideration of weight was also essential, for example, in understanding electrochemical equivalence.

3. *Imperial Measures*

On the job conversion from metric to Imperial or *vice versa* was often required.

4. *Fractions and Decimals*

An understanding of fractions and decimals was considered vital by trade teachers and was assumed in most calculations and diagrams. Apprentices needed them both in theory and practical work. An understanding of the powers of ten as well as decimals was needed: for example, the electrochemical equivalence of aluminium is 9.30 X 10^{8}. Conversions from fraction to decimal was also required daily.

5. *Ratio*

Whereas a general understanding of the concept of ratio may suffice on the job, at college voltage and resistance ratios are constantly being referred to.

6. *Percentages*

Percentage was an important concept used frequently particularly in reference to the efficiency of a motor.

7. *Statistics*

An understanding of statistics (for example, calculating a mean) was needed occasionally at college.

8. *Tolerances*

An understanding of tolerances was considered vital.

9. *Interpretation of Tables of Figures and Graphs*

Both the interpretation of tables and graphs were essential at college. As noted in the previous section on reading requirements on the job, much of the information contained in the *S.A.A. Wiring Book* was presented in a tabular form. This text formed a large part of the first year apprentices' theory course. Even a cursory glance at their major text, *Jenneson's Electrical Principles for the Electrical Trades*, illustrates the need students have for interpreting graphs.

10. *Technical Drawing Interpretation*

This was considered vital in both theory and practical classes. Texts frequently made reference to circuit diagrams. The first year program included at least one technical drawing class per week.

11. *Estimation of Error in Length/Area Tables of Figures*

As mentioned earlier, estimation of length was important. Estimation of the correct answer was also useful for those using calculators.

12. *Trigonometry and Geometry*

Whereas trigonometry was rarely used on the job, in theory at college an understanding of sine and cosine was essential for vector analysis. Simple geometry was used several times a week in theory classes and was assumed in much electrical theory (for example, wave forms).

13. *Algebra and the Transformation of Formulae*

Algebra was essential to most electrical theory. Many vital concepts (for example, Ohm's Law) were expressed in formulae. Students must understand how to substitute into these formulae as well as transpose them (change the subject of the formulae). Teachers reported that many students had difficulty handling algebraic transformation.

14. *Speeds*

As on the job, the concept of speeds was essential for the electrical fitter mechanic. They must be considered both in the practical classes (for example, in setting up tools or in testing a motor rewind) and in theory (for example, angular velocity and peripheral speeds).

II. FITTING AND MACHINING

A. *NUMERACY ON THE JOB*

As can be seen in Table 11, Appendix 'C' the fitter machinists in the workplace stated that considerable mathematics was required of them. As with electrical fitter mechanics this trade relies heavily on graphically presented information, technical drawings in particular. These are discussed in both literacy and numeracy sections.

1. *Computations*

Mental arithmetic, addition, subtraction, multiplication, and division were used daily and were considered to be vital by most fitters and machinists. These computations were necessary in most job calculations; in moving from plans to the workbench, in knowing how much to machine off, in ordering, adding dimensions, and in the use of verniers and micrometers. A number of tradespeople used calculators to perform these operations.

2. *Measurement*

Length was constantly referred to by fitter machinists when setting out and checking work. Tolerances were small and were usually measured with a vernier or micrometer. Accuracy was essential although some tradespeople would occasionally estimate length. Volume, area and weight were measures referred to less frequently. An apprentice working on maintenance and installation with a large food company reported that it was essential to know how to calculate area space; most tradespeople calculated area infrequently. Weight measures were used daily by fitters and machinists working on a large mining site.

3. *Imperial Measures*

Metrification caused many problems for the fitting and machining trades since most machines (for example, lathes, and presses) and measuring instruments were calibrated in Imperial whereas most materials were supplied in metric lengths. The fitter machinist must be able to use both measures and to convert from one to the other. Conversion charts were usually available for this purpose, however, the ability to quickly estimate Imperial and metric equivalence was obviously useful. Foremen involved in ordering large quantities of materials used calculators to determine the quantities they needed in either metric or imperial.

4. *Fractions and Decimals*

Fractions and decimals were used daily and considered to be essential by all the tradespeople interviewed and most of the apprentices. Specifications were expressed as fractions on Imperial plans and as decimals on metric plans. Verniers or micrometers were calibrated in either fractions or decimals, and the most accurate measures were expressed as tolerances in decimals. Tradespeople were frequently required to convert fractions to decimals and vice versa.

5. *Ratio*

Ratio was a useful concept for some fitters and machinists. Apprentices reported that they needed "the idea of it" to understand the use of gears and pulleys.

6. *Percentages*

The concept of percentages was essential to some sections of the trade. Some specifications and clearances, particularly on metric drawings, were expressed as percentages.

7. *Tolerances*

The concept of tolerances was critical for both tradespeople and apprentice fitter machinists. The accurate machining of fine tolerances forms the substance of the fitting and machining trade. Specifications on the drawings for jobs were often expressed as tolerances. Fitters installing or assembling machines, for example, gear boxes, need to follow clearance specifications which are always expressed in tolerances.

8. *Interpretation of Tables of Figures and Graphs*

Fitters and machinists did not report a need for interpreting graphs. Interpreting tables of figures was, however, considered vital and used daily by most tradespeople and apprentices. The most commonly cited tables read were metric conversion charts and drill, tap, and thread size charts. Many engineering specifications were also expressed in a tabular form, for example, clearances, bend allowances, and tolerances. (See Appendix 'A').

9. *Estimation of Error/Length/Area*

Some tradespeople felt strongly that the estimation of length and area had no place in the fitting and machining trade. As one tradesperson put it, "precision, not estimation, is required in this trade". Other tradespeople and apprentices found estimation useful when first thinking about how to do a job, for example, in making a dye, or when checking over the finished product.

10. *Estimation of Error in Sets of Figures and Money*

This was not a skill used by this sample of fitters and machinists.

11. *Interpretation of Technical Drawings*

The interpretation of technical drawings was considered to be vital by all tradespeople and apprentices. Drawings on jobs to be done were often to be seen spread out over the work bench. There were referred to constantly.

12. *Geometry, Trigonometry Algebra/Transformation of Formulae*

A basic understanding of geometry (angles, proportionate triangles) was vital for all tradespeople and apprentices working in the machine shop or in construction.

Simple trigonometry was used quite often by fitters and machinists. It was considered to be essential when working out dimensions, turning tapers, cutting, and checking the chamfers on edges.

Algebra was used very little by fitters and machinists; two tradespeople would use algebraic notation occasionally when calculating dimensions of an aperture.

13. *Speeds*

Speeds were considered vital by all tradespeople and by apprentices working in the machine shops. Most manufacturing machines (mills, lathes, drills) needed to be set at a particular number of revolutions per minute depending on the nature of the material being worked with and the speed at which materials were fed into the machine was crucial for the accurate machining of clearances.

B. *NUMERACY DEMANDS AT COLLEGE*

The numeracy requirements for fitters and machinists at college were quite extensive - most of the mathematical processes listed on the questionnaire (See Appendix 'C') were used at some stage in their college courses [1].

1. *Computations*

Mental arithmetic was considered essential and was used daily in measurement. Students needed to perform one of the four arithmetic operations on paper several times a week for example, in calculating the number of turns needed to machine a particular article.

Most students had a basic calculator and used it at least two or three times a week.

2. *Measurement*

Length was a vital concept in all college work, it was referred to several times a day. Area, volume and weight were only referred to occasionally and were considered useful as opposed to vital.

3. *Imperial Measures*

As in the workplace, at college, fitting and machining apprentices needed to be able to work in both metric and Imperial measures, reading both metric and Imperial micrometers and machines. Actual conversion from metric to Imperial was not often required.

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[1] Teachers were asked about the numeracy demands placed on 1st, 2nd and 3rd Year apprentices.

4. *Fractions and Decimals*

Fractions and decimals were both considered essential for the college work required of fitters and machinists. Tolerances were usually expressed as fractions or decimals of an inch. Occasionally conversion from fraction to decimal was required when both metric and Imperial systems were in use.

5. *Ratio*

An understanding of ratios was considered to be essential it would be used at least once a week when considering angles, speeds and gearing.

6. *Percentages*

The concept of percentages was needed occasionally in specifying clearances.

7. *Tolerances*

As in the workshop, the concept of tolerances was essential in the college training of fitters and machinists. Tolerances were discussed and used in both theory and practical classes daily.

8. *Interpretation of Tables of Figures and Graphs*

In college work graphs needed to be interpreted several times a week. In college texts a considerable amount of information was presented graphically, for example, the number of revolutions per minute against the diameter of the item being machined.

9. *Estimation of Error/Length/Area*

Length and area were rarely estimated. Measurements in fitting and machining were required to be as accurate as possible.

10. *Estimation of Error in Sets of Figures, Money*

Estimation of error in sets of figures was considered useful when students were checking the answers from their calculators.

11. *Interpretation of Technical Drawings*

Technical drawing interpretation was an essential skill, apprentices were required to do this daily.

12. *Geometry, Trigonometry Algebra/Transformation of Formulae*

An understanding of basic geometry (angles, geometric terms for cutting and gears) was considered essential and used two or three times a week.

Trigonometry likewise was essential and was used two or three times a week when determining angles of tapers and when laying out materials (angles, drill spaces).

Simple algebra including the transformation of formulae was used two or three times a week and considered essential. For example, in the theory of gear cutting, methods of cutting were frequently expressed as algebraic formulae.

13. *Speeds*

Speeds expressed as revolutions per minute were used daily and were considered to be vital in determining cutting speeds.

III. MOTOR MECHANICS

A. *NUMERACY ON THE JOB*

The mathematical requirements of the motor mechanic on the job are not as extensive as those of the electrical fitter mechanic or the fitter machinist. A sound grounding in basic computations and the ability to read tables of figures were mainly required.

1. *Computations*

Mental arithmetic was used daily and considered vital by all motor mechanics surveyed. They used it when tuning up or converting from metric to Imperial. A mechanic working on quotations for a large firm needed to use the four arithmetic processes constantly. The average mechanic in a garage used them less frequently, for example, when faced with a large calculation involving metric conversion of clearances. In some businesses, a calculator was used to perform these operations.

2. *Measurements*

Length was mentioned as an important concept by motor mechanics working on wheel alignments, fitting hoses, or engine fitting. Area and weight were concepts rarely used by the motor mechanic on the job. Volume was estimated occasionally by a truck mechanic calculating the volume of cylinders or the size of long-range fuel tanks.

3. *Imperial Measures*

Conversion from metric to Imperial and *vice versa* was a necessary skill for those working in firms where the vehicle specifications were expressed in Imperial, for example, with older or American vehicles.

Tolerances for tappet adjustment and spark plug gaps were sometimes converted from Imperial to metric. Metric conversion charts were widely available for this purpose, although the ability to estimate measures in both systems and to perform quick conversions were to a tradepersons' advantage.

4. *Fractions and Decimals*

An understanding of fractions and decimals was considered vital by the motor mechanics surveyed. Decimals were in daily use whereas fractions were used less often. Most specifications were expressed as tolerances of a fraction or a decimal but since an increasing number of vehicles were set in metric measures, the mechanic tended to work in decimals rather than fractions. As mentioned in the previous sections, conversion from one measure to another was also required.

5. *Percentages*

In some sections of the trade the mechanic was required to calculate percentages when giving quotations on the prices of certain jobs.

6. *Ratio*

An understanding of ratio was required by some sections of the trade. When working on gear boxes and differentials, ratios were referred to daily.

7. *Tolerances*

An understanding of tolerances was essential to all sections of the motor mechanics trade. They were referred to daily especially by those who worked on machining and reboring engines. Timing specifications, spark plug gaps and piston clearances are all expressed as tolerances.

8. *Interpretation of Tables of Figures and Graphs*

Tradespeople did not consider that graph reading was an essential part of their trade. On the other hand, apprentices reported that they referred to graphs on the oscilloscope in tuning bays when testing engine performance.

Both tradespeople and apprentices referred to tables of figures daily. They were vital to the completion of many tasks. Most of the information in vehicle manuals, for example, specifications and tolerances, was expressed in tabular form.

9. *Estimation of Length/Area and Error in Length/Area*

Tradespeople stressed the accuracy of measurement required by this trade, estimation had little place in it. By contrast, apprentices reported that they would estimate size and distance frequently, for example, in estimating the size of nuts.

10. *Estimation of Error in Sets of Figures and Money*

This is a skill rarely used by the motor mechanics surveyed. Only one tradesperson working with a private service station reported that he would occasionally estimate the cost of a particular job. This was usually done by the driveway attendant.

11. *Interpretation of Technical Drawings*

Tradespeople reported that they would occasionally refer to electrical wiring diagrams or exploded diagrams of mechanical layout. They stated that this was becoming increasingly the job of the auto electrician. Apprentices reported using these kinds of diagrams with slightly greater frequency than tradespersons.

12. *Geometry, Trigonometry Algebra/Transformation of Formulae*

A basic understanding of angles, for example, cam and dwell angles, was required daily by motor mechanics in tuning engines. Trigonometry and algebra were not reported as being used by mechanics on the shop floor.

13. *Speeds*

The concept of speeds was used daily and considered essential by both tradespeople and apprentices. Revolutions per minute were considered in tuning and governing and when setting the range for gear changes.

B. *NUMERACY DEMANDS AT COLLEGE*

The numeracy requirements of motor mechanics at college were extensive, most of the mathematical processes listed were used at some stage in their college courses [1].

1. *Computations*

Mental arithmetic was used daily and considered essential by teachers of motor mechanics at college. The four arithmetic operations were essential for work on axles and gears and verniers and micrometers. Most apprentices used a calculator to perform these operations. Teachers reported that students had difficulty with these basic computations.

2. *Measurement*

The concept of length was used daily and considered essential in the college work of motor mechanic apprentices. Verniers and micrometers were used for measurement in engine overhaul, general repairs, and wheel alignment. Volume, area and weight were also considered to be essential concepts. These were used in the theory of pistons and hydraulics, and in calculating areas for brake lining, cylinder volume, and cubic capacity. Although considered essential, they were not referred to as frequently as length.

3. *Imperial Measures*

The ability to convert from metric to Imperial was an essential skill which was used daily in both the theory and practical components of college work.

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[1] The requirements of 1st, 2nd and 3rd Year students were considered in both straight motor mechanics and heavy vehicle commercial strands.

4. *Fractions and Decimals*

Fractions and decimals were used daily and considered essential in college work. Tool sizes and engine specifications were usually expressed in tolerances of fractions and decimals, with decimals being used slightly more often.

Conversion from fractions to decimals was also an essential skill used daily.

5. *Ratio*

A general understanding of the concept of ratio was required daily in understanding gear and axle theory and practice.

6. *Percentages*

A general appreciation of the concept of percentage, for example, in tyre profiles, was all that was required of apprentices.

7. *Tolerances*

These were used daily and considered essential for apprentice motor mechanics in both theory and practical work; most engine specifications are expressed as tolerances. As one teacher put it, "you are talking in terms of tolerances all the time".

8. *Interpretation of Tables of Figures and Graphs*

In the set text, information was often presented in graphical form. It was essential for students to be able to read these, although they may not need to do it very often. As in the workshop, tables of figures, for example, settings and specifications, were to be read daily and considered essential.

9. *Estimation of Length/Area and Error in Length/Area*

Estimation was only required occasionally. Staff stress the precision required in this trade.

10. *Estimation of Error in Sets of Figures/Money*

This was not required in the college work of apprentice motor mechanics.

11. *Interpretation of Technical Drawings*

Technical drawings were used daily and considered essential. Much of the motor mechanics text consists of exploded diagrams of mechanical layouts and circuit wiring diagrams. Teachers reported that apprentices had difficulty in interpreting technical drawings because they had no concept of three dimensional drawings.

12. *Geometry, Trigonometry, Algebra/Transformation of Formulae*

An understanding of angles was required by apprentices in both the theory and practice of motor mechanics. Trigonometry was not seen as a necessary skill for apprentices. A basic understanding of algebraic formulae was essential for completing much of the theory of the mechanic course.

13. *Speeds*

The concept of speeds was used daily and was considered essential in the theory and practical components of the course.

IV. CARPENTRY AND JOINERY

A. *NUMERACY ON THE JOB*

The mathematical requirements of the carpenter and joiner on the job were not as extensive as those of the electrical fitter mechanic or the fitter machinist. An ability to perform basic computations, measure and estimate length and area, and read technical drawings were mainly required.

1. *Computations*

Mental arithmetic was used daily and considered vital by both tradespeople and apprentices. It was used in working out measurement and spacing, in determining grids on drawings, and the levels of floors and ceilings. The four arithmetic processes were used daily by tradespeople in ordering materials or when a more complicated set of specifications needed to be calculated. This usually only involved fairly basic addition or subtraction. A calculator was used by tradespeople when there was one available.

2. *Measurement*

The concepts of length and area were considered vital and were used daily by carpenters and joiners both in construction and in the interpretation of plans. Volume and weight were also important concepts; in concrete form work the volume of concrete required must be calculated. Weight needed to be estimated for crane capacity.

3. *Imperial Measures*

The tradespeople tended to work in either Imperial or metric and there was only occasionally a need to convert from one measure to another.

4. *Fractions and Decimals*

The ability to work with decimals was essential and used daily by carpenters and joiners. Fractions were also important but were used slightly less frequently. Conversion from fractions to decimals was only necessary occasionally and would tend to be estimated.

5. *Ratio*

Ratio, as it applies in reading the scale of drawings, for example, 1:100 or 1:30, was used daily and considered essential by carpenters and joiners.

6. *Tolerances*

An understanding of tolerances was needed daily and was considered essential in interpreting Australian standards, for example, in concrete reinforcement.

7. *Interpretation Tables of Figures and Graphs*

Australian standards and architects' specifications were often expressed in a tabular format and required the carpenter and joiner to interpret tables of figures.

The carpenter and joiner was also occasionally required to interpret graphs, for example, crane capacity.

8. *Estimation of Length/Area or Error in Length/Area*

The ability to estimate error in length and area was vital and used daily by carpenters and joiners.

9. *Estimation of Error in Sets of Figures/Money*

This was not required of the carpenters and joiners interviewed in this sample.

10. *Interpretation of Technical Drawings*

The ability to read and interpret plans was needed daily and considered essential by all tradespeople. As mentioned in the section on the literacy requirements of the trade, reading plans tended to be the responsibility of the foreman on the job.

11. *Geometry, Trigonometry, Algebra/Transformation of Formulae*

An understanding of simple angles and Pythagoras' theorem was essential for carpenters and joiners in erecting roofs and setting up saws. Algebra and trigonometry were, by contrast, rarely required on the job.

12. *Speeds*

Speeds were referred to only occasionally, for example, in the setting up of drills.

B. *NUMERACY DEMANDS AT COLLEGE*

The mathematics required of first, second and third year apprentice carpenters and joiners at college was quite extensive. Most of the mathematical processes listed were considered 'vital' although they were not all in daily use.

1. *Computations*

Mental arithmetic was needed daily and considered essential for measurement and practical work. The four arithmetic processes were also essential and used several times a week in trade calculations, for example, in costing and ordering quantities of materials. Calculators were used for some of these operations. They were in use daily and were considered essential.

2. *Measurement*

Length and area were concepts which were referred to daily and considered vital in both theory and practical classes. Weight and volume were also vital concepts although not referred to as frequently as length and area. Weight is an essential consideration when calculating dimensions of different structures.

3. *Imperial Measures*

Occasionally an apprentice will be required to convert, or estimate the converted value, from metric to Imperial or *vice versa*.

4. *Fractions and Decimals*

Apprentices needed to be able to work in both fractions and decimals at college. Decimals were considered to be slightly more important than fractions.

5. *Ratio*

An understanding of ratio was considered vital for apprentices, they would use ratio two or three times a week in interpreting scales on drawings and in the construction of roofs and stairs.

6. *Percentages*

An understanding of percentages was considered vital for apprentices in the use of various formulae needed in construction, for example, the percentage moisture content of a particular material.

7. *Statistics*

The most required of the apprentice was the occasional calculation of an average.

8. *Tolerances*

A general understanding of tolerances, for levelling sites, was all that was required of the apprentice carpenter and joiner at college.

9. *Interpretation of Tables of Figures and Graphs*

The ability to interpret tables of figures was vital for the apprentice when he was required to read Australian Standards Association specifications, for example, in the relationship of size of roof and timber size and grade. Graphs were rarely encountered by the apprentice.

10. *Estimation of Length/Area or Error in Length/Area*

This was an essential skill, particularly in the levelling of sites. It was used two or three times a week.

11. *Estimation of Error in Sets of Figures/Money*

This was not a necessary skill among apprentices at college.

12. *Interpretation of Technical Drawings*

Apprentice carpenter and joiners were required to read technical drawings, usually plans, for two hours each day during their block. Teachers reported that apprentices experienced considerable problems in this area.

13. *Geometry, Trigonometry, Algebra/Transformation of Formulae*

More demands were placed on the apprentice carpenter and joiner in geometry, trigonometry and algebra at college than in the workplace. Geometry, an understanding of angles in particular, was required of the apprentice several times a week. Trigonometry and Pythagoras' theorem were essential to an understanding of roof construction. An understanding of basic algebra was vital as algebraic formulae were used to express relationships between materials and structures. Apprentices also needed to be able to calculate square roots.

14. *Speeds*

The concept of speeds was rarely used in either the theory or practice of carpentry and joinery at college.

V. PAINTING AND DECORATING

A. *NUMERACY ON THE JOB*

The numeracy requirements of painters on the job were not extensive. As with literacy requirements of the job, the responsibility for any mathematics required on the job lay with the foreman. The following mathematical processes were the only ones listed by tradespeople as being used on the job.

1. *Computations*

   A facility with the basic computational processes, both mentally and on paper, was important and in use several times a week.

2. *Measurement*

   Area and length were concepts used frequently by painters in ordering, reading specifications and drawings, and in planning jobs.

3. *Estimation of Length/Area*

   Although accurate measures were required, painters usually estimated areas and length. Accurate conversion from Imperial to metric was not often required by painters on the job.

4. *Percentages*

   One employer stated that a basic understanding of percentages would be useful.

5. *Ratio*

Although mathematical calculations involving ratio were not required, the concept of ratio was implied in many labels and package directions, for example, in mixing proportions of paint and solvents.

6. *Technical Drawing Interpretation*

The painter may occasionally need to interpret technical drawings, usually in the form of plans. In the cases we surveyed, these have been interpreted by some one higher in the hierarchy, the builder, architect or foreman. The painter is merely told what to do.

B. NUMERACY DEMANDS AT COLLEGE

College work placed more mathematical demands on the apprentice painter than did the work situation.

1. *Computations*

Mental arithmetic was used several times a week and the four arithmetic operations were in use daily. Apprentices were encouraged to set out all calculations on paper so that errors could be easily detected. Calculators were not used.

2. *Measurement*

A major aspect of their arithmetic studies was the calculation of area. See Appendix 'B' for details of formulae required and the measurement of length. College teachers found that apprentices had considerable difficulty in this area; they were unable to apply formulae and to set out a problem in a systematic way, for example, calculations of the amount of paint and wall paper required on a particular job. Many apprentices were unable to see the point of doing such calculations when they were not required to do so by their employers. Apprentices were not required to calculate volume and weight.

3. *Imperial Measures*

Conversion from Imperial to metric and *vice versa* was rarely required.

4. *Fractions and Decimals*

Both fractions and decimals were required at least weekly in calculating areas and quantities of materials needed.

5. *Ratio*

As on the job, an understanding of ratio and proportion was required in mixing proportions of paints and solvents.

6. *Percentages, Statistics and Tolerances*

The calculation of these was not required of apprentice painters.

7. *Interpretation of Tables of Figures and Graphs*

The interpretation of graphs was not required in college work. Occasionally information was presented in a tabular form.

8. *Estimation of Length/Area or Error in Length/Area*

Apprentice painters were frequently required to estimate length, area, and quantities of materials required.

9. *Estimation of Error/Figures/Money*

This was not required of apprentice painters.

10. *Interpretation of Technical Drawings*

A basic understanding of orthographic projection was required by first year apprentices.

12. *Geometry, Trigonometry, Algebra and Speeds*

An understanding of angles was required in the interpretation of technical drawings. Other than this, little understanding of geometry and trigonometry was required at college. Apprentice painters were not required to work with algebra and speeds.

VI. COOKING

A. *NUMERACY ON THE JOB*

The amount of mathematics required of the cook in the work place varied according to the size of the kitchen and his range of responsibilities. All cooks needed the concept of weight but not all were required to perform many computations; for example, in the mess of a large mining site there may be a number of cooks - the cook-in-charge, responsible for ordering in food and planning menus, and the cook who simply prepares the food. The cook-in-charge of ordering needed to be more competent at basic computational mathematics.

1. *Computations*

Most cooks interviewed stated that mental arithmetic was vital on the job and was used several times a week, if not daily, in adjusting recipes, calculating portion size, and costing. The cook would also be required to set down these arithmetic operations and perform a calculation several times a week. Only two cooks had access to a calculator to perform these operations.

2. *Measurement*

Weight was a vital concept for cooks: it was in use daily. Volume was also considered to be a vital concept, although volume here referred to an amount of liquid rather than a quantity calculated using a formula. Length and area were not generally important concepts although an eye for shape and proportion was clearly useful in the presentation of meals.

3. *Imperial Measures*

Cooks needed to be able to convert from Imperial to metric and *vice versa* occasionally as some hotels still used Imperial scales and recipes.

4. *Fractions and Decimals*

The ability to perform computations with fractions was not required by cooks although it would be useful for them to be able to mentally halve and quarter quantities. Cooks working in metric were required to perform similar operations with decimals.

5. *Ratio*

No mathematical understanding of ratio was required, however, many basic recipes involved an understanding of the relationship between proportions of ingredients.

6. *Percentages*

An understanding of percentages was considered essential by most cooks. They would use it at least weekly in determining prices and mark-ups.

7. *Statistics*

Some cooks kept simple statistics, for example, totals and means, on the number of meals served each week. This was essential in large mess situations and for planning orders.

8. *Tolerances*

An understanding of tolerances in the engineering sense was not required by cooks.

9. *Interpretation of Tables of Figures and Graphs*

The cook had to interpret tables of figures occasionally. For example, in one large catering firm, monthly figures were displayed in tabular form: these needed to be interpreted for costing and estimation. The interpretation of graphs was not required by cooks.

10. *Estimation of Length/Area and Error in Length/Area*

This was not required of cooks.

11. *Estimation of Error in Sets of Figures/Money*

This was an essential skill in some areas of the trade. For example, a cook working for a large catering firm had to be able to estimate the cost of a function.

12. *Interpretation of Technical Drawings, Geometry, Trigonometry, Algebra and Speeds*

Cooks did not need any of these concepts in the workplace.

B. *NUMERACY DEMANDS AT COLLEGE*

1. *Computations*

Mental arithmetic and the four arithmetical operations were considered to be essential to the course work of cooks at college. Simple mental arithmetic was useful for calculating quantities of ingredients and portions. The four arithmetic operations were needed in theory work, for example, in costing orders, and estimating and designing kitchen areas. Teachers reported that students had difficulty with multiplication and long division.

2. *Measurement*

The most important concept of measurement with which cooks must be familiar is weight since all recipes specify amounts of ingredients in weight. Students needed to be familiar with measures of volume, for example, the decilitre.

3. *Imperial Measures*

Students may also be required to convert from Imperial to metric measures. Many recipe books still specify quantities in Imperial measures.

4. *Fractions and Decimals*

The ability to work with both fractions and decimals was essential in calculating quantities for recipes, in the theory of costing and control, and in calculating orders of supplies for the kitchen. Staff found that students had difficulty with dividing up portions. One teacher found it necessary to physically demonstrate what it meant to divide a fillet of steak into eight.

5. *Ratio*

While apprentice cooks were not required to calculate ratios mathematically, they needed to have a general understanding of proportions of ingredients for use in recipes.

6. *Percentages*

The ability to work with percentages was essential in theory classes where costs and percentage profit and loss were calculated.

7. *Tolerances*

Tolerances in the engineering sense were not referred to.

8. *Interpretation of Tables of Figures and Graphs*

The apprentice cook was only occasionally required to refer to tables of figures and graphs.

9. *Estimation of Error/Length/Area*

This was not a skill generally required of apprentice cooks.

10. *Estimation of Error in Sets of Figures/Money*

The ability to estimate prices was an essential component of the apprentices' 'cost and control' theory subject.

11. *Interpretation of Technical Drawings*

An elementary understanding of technical drawings was essential when apprentice cooks were required to draw up kitchen plans.

12. 13. *Geometry, Trigonometry, Algebra, Speeds*

These mathematical skills were not required by the apprentice cook.

VII. HAIRDRESSING

A. *NUMERACY DEMANDS IN THE WORKPLACE*

As can be seen in Table 11 the hairdresser in the workplace was not required to do extensive numerical calculations.

1. *Computations*

Mental arithmetic was important for tabbing prices, mixing peroxides and dyes. The ability to estimate the approximate cost of service was also useful. However, the tradesperson was unlikely to actually sum things on paper. Some salons had a cash register which the hairdresser was required to use.

2. *Measurement*

An appreciation of length, area, volume, and weight was required in treating and cutting hair. As estimation of these was required rather than a direct measurement.

3. *Imperial Measures*

Conversion from metric to Imperial was not required in this trade.

4. *Fractions and Decimals*

An appreciation of fractions and decimals, for example, measuring out proportions of solutions, was all that was required of the hairdresser.

5. *Ratio*

An understanding of the concept of ratio was useful for mixing solutions and dyes. No calculations were necessary and proportions were usually labelled on the packages.

6. *Percentages and Statistics*

Some understanding of percentages and elementary statistics was needed for the staff of one large firm in their self-monitoring system. Calculating discounts for prices also involved a percentage.

7. *Tolerances*

Tolerances in the engineering sense were not used in this trade.

8. *Interpretation of Tables of Figures and Graphs*

Manufacturer's instructions were sometimes expressed in a tabular form, for example, the proportion of peroxide required for different hair types, and these were required to be read occasionally.

9. *Estimation of Length/Area or Error in Length/Area*

This skill was required daily in the treatment and cutting of hair.

10. *Estimation of Error in Figures/Money*

The ability to estimate the total price of a salon visit would be useful for the hairdresser.

11. *Interpretation of Technical Drawings*

This ability was not required of the hairdresser.

12. *Geometry, Trigonometry, Algebra*

The ability to estimate angles was necessary for the hairdresser in cutting hair. Apart from this, geometry, trigonometry and algebra were not used by the hairdressers.

B. *NUMERACY DEMANDS AT COLLEGE*

As on the job, the mathematical requirements of the apprentice hairdresser at college were very few. The only skills listed by staff were:-

1. *Mental Arithmetic*

   This was required daily in mixing proportions.

2. *Interpretation of Tables of Figures*

   This was required in practical classes in interpreting manufacturer's instructions, for example, colour charts.

3. *Estimation of Length/Area/Weight and Angles*

   This estimation was required in the cutting of hair.

VIII. PLUMBING AND DRAINING

A. *NUMERACY DEMANDS IN THE WORKPLACE*

1. *Computations*

Both mental arithmetic and written calculations were needed by plumbers on the job (for example, when the dimensions of piping had to be determined in accordance with plans or the by-laws). Calculators were not used by the tradespeople interviewed.

2. *Measurement*

The accurate measurement of length was essential for the plumber putting in fixtures and working in accordance with by-laws and scaled drawings. Area occasionally needed to be estimated. Volume was only occasionally referred to on plans and specifications. Plumbers could refer to books of specifications, for example, *Lysaght's Referee.* Plumbers needed to gauge weight accurately in the suspension of pipes (this was usually the responsibility of the leading-hand).

3. *Imperial Measures*

It was helpful for the plumber to be able to work both in Imperial and metric measures as in older buildings and with older plans specifications were still in Imperial. Most tradespeople either knew metric equivalences off by heart or used a double sided tape.

4. *Fractions and Decimals*

Both fractions and decimals were required when interpreting plans, determining measurements and when cutting materials to size. Conversion from fractions to decimals was required only when the plumber was converting from metric to Imperial.

5. *Ratio*

An understanding of ratio was useful in the theory of plumbing work (for example, in the relationship between the slope of roofing and the fall of pipes). The plumber would rarely be called on to use ratio on the job.

6. *Percentages*

The concept of percentages was only occasionally referred to and that was by the foreman when he was costing jobs.

7. *Statistics*

An understanding of statistics was not required.

8. *Tolerances*

The plumber needed a sound understanding of the concept of tolerances in his work. He needed to consider them when fitting pipes of different materials as each would have a different rate of contraction and expansion. When working on large industrial sites plumbers had to work to precise tolerance so as not to collide with other ducting and pipe systems (for example, steam and gas).

9. *Interpretation of Tables of Figures/Graphs*

Graphs were rarely referred to by the plumber. Tables of figures needed to be interpreted regularly as specifications on plans and much of the information in the By-Laws was in tabular form.

10. *Technical Drawing Interpretation*

The ability to read technical drawings was essential for the plumber as he was frequently referring to building and plumbing plans. The ability to sketch technical details was also to the plumbers advantage, as one plumber put it: "the tradesmen speak through sketches".

11. *Geometry, Trigonometry and Algebra*

In roofing, the construction of down pipes and when bending pipe, it was essential for plumbers to determine specifications in angles. When working in the workshop on the construction of roofing and pipes a basic understanding of geometric concepts would be helpful. Trigonometry and algebra were not referred to by the plumber on the job.

12. *Speeds*

An understanding of speeds in terms of the flow rate of water per minute was important for the plumber seeking to interpret the by-laws, for example, certain sizes of pipe are specified for particular rates of flow.

B. NUMERACY DEMANDS AT COLLEGE

Extensive mathematics was required of apprentice plumbers at college. There was an emphasis on the accurate measurement of length and area.

1. *Computations*

Mental arithmetic was needed daily and considered essential both in theory and practical work. Apprentices were also required to set down calculations on paper. However, the actual computation was frequently performed on a calculator. Computational skills were most frequently needed in the area of measurement, for example, in determining dimensions in roofing and down pipes.

2. *Measurement*

Length, area and volume were essential concepts for the plumbing apprentice at college. As accurate measurement of length and area was required, an estimate of volume (for example, in flow rates) was usually sufficient although the apprentice could be required to calculate volume using a formula. Weight was a slightly less important consideration than length, area and volume - however, apprentice plumbers could be called on to estimate weight (for example, the weight of water when considering the tolerances of certain structures) and to give accurate measures of weight (for example, in considering quantities of L.P. Gas).

3. *Imperial Measures*

Apprentices at college could be required to convert from metric to Imperial on occasions, some plumbing plans still expressed dimensions in Imperial measures and many older plumbers still converted metric dimensions back to Imperial.

4. *Fractions and Decimals*

The ability to work in both fractions and decimals was essential for apprentice plumbers. Decimals tended to be used more than fractions. Apprentices could also be required to convert fractions to decimals and *vice versa*.

5. *Ratio*

An understanding of ratio was essential for mixing plumbing materials.

6. *Percentages*

In college work the apprentice plumber was required to calculate percentages when calculating profits and costing.

7. *Statistics*

Statistical understanding was not required by apprentice plumbers.

8. *Tolerances*

Apprentice plumbers needed a general understanding of tolerances rather than the detailed knowledge required by the engineering trades.

9. *Interpretation of Tables of Figures and Graphs*

The ability to interpret tables of figures was essential for plumbing apprentices reading the *Standard Water Supply and Sewerage By-Laws* in which many specifications are presented in a tabular form. Graphs were rarely required to be read by apprentices.

10. *Interpretation of Technical Drawings*

This was an essential skill for apprentice plumbers, much of the information in the by-laws was presented in the form of plans or exploded diagrams. At the end of his third year the apprentice was expected to draw up a complete set of plumbing plans for a building.

11. *Geometry, Trigonometry and Algebra*

An understanding of geometry, for example, knowledge of angles, Pythagoras' theorem, was required by apprentice plumbers working on the theory of roofing and the construction of down pipes. Trigonometry was rarely referred to. Apprentices were required to apply some algebraic formulae and transformations in the theory of plumbing work.

12. *Speeds*

The only reference apprentice plumbers had to make to speed was in the flow per second rate of water and sewerage.

IX. BOILERMAKING

A. *NUMERACY DEMANDS IN THE WORKPLACE*

1. *Computations*

Both mental arithmetic and written calculations could be required daily on the job especially when the boilermaker was laying out a job from a scaled drawing, for example, distances between bolts had to be calculated and measured. Calculators were used occasionally when available.

2. *Measurement*

Length and area were essential concepts for the boilermaker in use daily in the laying out of materials for fabrication and repair. Volume needed to be estimated occasionally in the construction of tanks and other cylindrical shapes. Weight also needed to be estimated by the boilermaker when he was considering tolerances for cranes and when he was ordering in materials.

3. *Imperial Measures*

It was essential for the boilermaker to be able to work with both Imperial and metric measures as he could be asked to work to old drawings and specifications which were still drawn up with Imperial measures. Although it was handy for the tradesperson to be able to calculate metric equivalents mathematically, he usually did this by consulting a double sided tape or a metric conversion chart.

4. *Fractions and Decimals*

Drawings and specifications both contained dimensions in fractions and decimals. The boilermaker needed to be able to work in both. Occasionally he was required to convert from fractions to decimals and *vice versa.*

5. *Ratio*

Ratios were not required in the work of the boilermakers interviewed in this sample.

6. *Percentages*

Percentages were not required in the work of the boilermakers interviewed in this sample.

7. *Statistics*

Statistics were not required in the work of the boilermakers interviewed in this sample.

8. *Tolerances*

The boilermaker's drawings usually specify the tolerances to which an article needs to be manufactured. Thus, it was essential for the boilermaker to have an understanding of the concept. However, the boilermaker's tolerances were nowhere near as fine as those required of the fitter and machinist.

9. *Interpretation of Tables of Figures and Graphs*

The boilermaker needed to be able to interpret tables of figures as specifications on drawings, drill and tap size charts and metric conversion charts were all in a tabular form. He was rarely called on to interpret graphs.

10. *Technical Drawing Interpretation*

This was probably the single most important literacy and numeracy skill required of the boilermaker. As stated earlier, the boilermaker refers constantly to his drawings when manufacturing and to a lesser extent when doing repair work.

11. *Geometry, Trigonometry and Algebra*

Basic geometry was used daily by the boilermaker. He needed to measure angles and to be familiar with the names of geometric shapes - cones, rectangles and circles. He used 'rules of thumb' for checking his layout work, for example, squaring a plate by checking the diameters were 3 : 4 : 5. These involved some understanding of geometry and a little trigonometry. Algebra was not required on the job.

12. *Speeds*

Speed was a consideration when the boilermaker selected drill sizes and when he was controlling the size of a weld when using metal inert gas.

B. *NUMERACY DEMANDS AT COLLEGE*

The apprentice boilermaker was required to be familiar with a range of mathematical operations. However, the mathematical requirements of the trade were not as extensive as those of 'A' class trades like diesel fitting, fitting and machining and electrical fitter mechanics.

1. *Computations*

Mathematical computations were required by the boilermaker daily. They were considered essential. Most apprentices would either perform calculations with pencil and pad or on a calculator. Only very simple computations were performed mentally.

2. *Measurement*

Length, area and weight (expressed in formulae as "mass") were essential concepts for the apprentice boilermaker. Both accurate measurements and estimates of length and area were required. Apprentices were rarely asked to estimate or calculate volume.

3. *Imperial Measures*

At college there was little need to convert from metric to Imperial since most specifications and drawings were in metric measurements.

4. *Fractions and Decimals*

The ability to work with fractions and decimals was considered essential as most measurements on drawings were expressed as a decimal or a fraction. The apprentice could also be required to convert from fractions to decimals and *vice versa.*

5. *Ratio*

An understanding of ratio was not required of the apprentice boilermaker at College.

6. *Percentages*

An understanding of percentages was not required of the apprentice boilermaker at college.

7. *Statistics*

An understanding of statistics was not required of the apprentice boilermaker at college.

8. *Tolerances*

An understanding of tolerances was essential for the apprentice boilermaker who was required to cut, lay out and weld to certain specifications.

9. *Interpretation of Tables of Figures and Graphs*

Apprentice boilermakers were frequently required to interpret tables of figures, for example, on drawings, specifications were often displayed in a tabular form. In college notes students could be required to interpret graphs as theory, for example, pre-heat requirements of particular steels, stress and strain diagrams, were sometimes presented on graphs.

10. *Technical Drawing Interpretation*

Apprentices needed to interpret technical drawings daily since almost all the practical work required of the apprentice boilermaker involved following plans of the job to be done.

11. *Geometry, Trigonometry and Algebra*

A basic understanding of angles and Pythagoras' Theorem was useful for apprentice boilermakers. Algebra was not generally required of them.

12. *Speeds*

Apprentice boilermakers were required to consider the speed and feed rates of drills in construction. These were usually read from a chart on the workshop wall.

X. FITTING (DIESEL AND HEAVY EARTH MOVING EQUIPMENT)

A. *NUMERACY DEMANDS IN THE WORKPLACE*

1. *Computations*

Mental arithmetic was considered essential by most diesel fitters in setting up points and gaps to certain specifications and when using gauges in testing engine performance. The tradesperson might also need to perform these computations on paper. Written calculations were also required when the diesel fitter was involved in rebuilding engines and in fabrication and frame work.

2. *Measurement*

Concepts of length, area and volume were not as essential to this trade as to trades heavily involved in construction. Accurate measurement of length and area were important when the diesel fitter was rebuilding engines. Weight needed to be considered when determining what size chain was needed for lifting a particular weight.

3. *Imperial Measures*

The ability to use both Imperial and metric measures was essential for diesel fitters since much of the equipment they worked on was American (thus, still calibrated in Imperial) and gauges they used were metric. To some extent this problem has been overcome by the larger companies who state engine specifications in both metric and Imperial. It was still necessary for the tradesperson to know equivalences or be able to convert quickly from pounds per square inch to kilopascals.

4. *Fractions and Decimals*

The ability to work in both fractions and decimals was essential for the diesel fitter, many tradespeople would use them daily in setting heads and tappets, in engine rebuilding size of plate steel, bolts, crankshaft measurements could all be expressed as fractions and decimals.

5. *Ratio*

An understanding of ratio was occasionally useful when rebuilding engines and setting up gear boxes.

6. *Percentages*

Diesel fitters used percentages when writing up reports, for example, a report would contain details like "sixty per cent wear on clutch, ten percent of original wear on tyres". Actual calculation of percentage was rarely required.

7. *Statistics*

Statistical understanding was not required by diesel fitters.

8. *Tolerances*

Using tolerances was an essential component of the diesel fitters work each day. Almost all specifications for engines in manuals were expressed as tolerances. An understanding of tolerances was essential in every aspect of engine rebuilding.

9. *Interpretation of Tables of Figures and Graphs*

Most specifications in manuals were in table form, thus the ability to interpret tables of figures was essential for the diesel fitter. Graphs needed to be interpreted occasionally as the efficiency of engines in terms of horsepower and temperature was sometimes expressed in the form of a graph.

10. *Technical Drawing Interpretation*

Service manuals and parts books contain numerous technical drawings (exploded views of parts, electrical circuit diagrams). These were essential reading for the diesel fitter.

11. *Geometry, Trigonometry and Algebra*

A basic understanding of angles was needed for engine timing. Apart from this, very little geometry, trigonometry and algebra were required by diesel fitters.

12. *Speeds*

A consideration of speeds (usually stated as the number of revolutions per minute) was essential for most diesel fitters in testing engine performance and in tuning, timing and governing.

B. *NUMERACY DEMANDS AT COLLEGE*

1. *Computations*

Mental arithmetic was required daily and considered vital for apprentice diesel fitters in the area of measurement. Written calculations were also performed daily. Apprentices were encouraged to set out arithmetic problems to assist them in clear logical thinking. There was no restriction on the use of calculators and most apprentices used them daily.

2. *Measurement*

The accurate measurement of length was needed daily and considered to be essential for diesel fitters (precision instruments, for example, verniers and micrometers were widely in use). As one teacher put it, "a ruler only provides an estimate". Learning to jot down sets of figures was essential as in the use of some instruments, up to four sets of readings were required. The diesel fitter was required to read a wide variety of gauges and dials. Area is another essential concept which must be considered when working in the theory of engineering for example, principles of air pressure, hydraulics and Pascal's Law. Weight had to be considered when balancing engines, crankshafts and turbo-chargers in such a way as to counteract twisting forces. An understanding of volume was required in the theory of compression ratios.

3. *Imperial Measures*

Conversion from Imperial to metric and *vice versa* was required daily and considered to be vital in this trade as so many engines are American and still set to Imperial specifications. Apprentices were required to perform the conversion by calculation.

4. *Fractions and Decimals*

Both fractions and decimals were in use daily and were considered essential, for example, *fractions* were essential in calculating resistance in series and all specifications in manuals were expressed as tolerances of a *decimal*. Apprentices were also required to convert from fractions to decimals when using metric measuring instruments.

5. *Ratio*

An understanding of ratio was essential and referred to several times a week in both theory and practical classes, for example, in setting different speeds for gear box ratios.

6. *Percentages*

Percentages were only occasionally referred to in the area of engine testing.

7. *Statistics*

Statistical understanding was not required by diesel fitters.

8. *Tolerances*

As mentioned earlier, specifications for most diesel and heavy earth moving equipment were expressed as tolerances of decimals, thus tolerances were used daily by apprentices and were considered essential.

9. *Interpretation of Tables of Figures and Graphs*

The ability to interpret tables was essential and in use daily in the reading of engine specifications and material in texts and notes. Some material was presented in graphs, for example, graphs of torque and horsepower, and the ability to read was useful.

10. *Interpretation of Technical Drawings*

The interpretation of technical drawings was essential for the apprentice diesel fitter, information in service manuals and in text books was often displayed in diagrams or exploded views. In interpreting these technical drawings, the apprentice would need to interpret colour codes, he would also need to be familiar with *The Australian Standard Symbols* for heavy earth moving equipment.

11. *Geometry, Trigonometry and Algebra*

An understanding of geometry was useful for the apprentice diesel fitter working on layout work in construction. An understanding of basic geometry would also be useful in understanding steering systems. Trigonometry was not an essential skill. Algebra would be used several times a week in determining unknown quantities in the application for formulae.

12. *Speeds*

Speed, that is, revolutions per minute, was an essential concept in use daily in engine testing.

CHAPTER 6

SELECTION OF APPRENTICES

The first hurdle faced by the school leaver seeking to enter a trade was the employer's selection procedure. High rates of youth unemployment have given employers a large pool of applicants to choose from; in some cases the employer may have some two hundred applicants out of which he will only be able to choose six apprentices.

Selection procedures varied considerably from businesses which utilized a battery of standardised tests to those which relied on subjective personal impressions. Objective testing appeared to be used mostly by larger companies, particularly those which conducted their own training schools. Subjective selection occurred mainly in small firms which were subject to family influence and personal recommendation. The most significant outcome of these selection variations occurred when apprentices attended their T.A.F.E. college courses. Those apprentices who had been selected as a result of an objective testing program did not appear to have literacy or numeracy problems and usually did well in their courses. On the other hand, apprentices who had difficulty with the literacy and numeracy demands of T.A.F.E. courses were invariably employed by businesses which relied on subjective personal appraisal.

The only given criteria which must be adhered to are the educational standards specified by the Industry and Commerce Training Commission. These, along with the criteria used by employers, will now be considered in terms of the literacy and numeracy demands placed on the applicant.

INDUSTRY AND COMMERCE TRAINING COMMISSION ENTRY REQUIREMENTS

In terms of school based assessment of literacy and numeracy, applicants for apprenticeship were required to reach certain minimum standards stipulated by The Queensland Industry and Commerce Training Commission:

A. *Class Trades* (including electrical fitter mechanics and fitting and machining),

- a rating of '3' or more in English,
  one Science subject, and
  one Mathematics subject at Junior.

B. *Class Trades* (including motor mechanics, plumbers, and carpenters and joiners),

- completion of Grade Nine in Queensland.

C. *Class Trades*

- Completion of Grade Eight in Queensland.

Although these standards appear to impose a minimum level of literacy and numeracy which must be achieved by all those entering a trade, in practice that level of literacy and numeracy is not made clear.

For example, in 'A' Class Trades, no level of Mathematics was specified leading to a situation where the T.A.F.E. teacher was able to comment that, in his experience, a student with a '3' in General Mathematics almost invariably needed remedial classes.

In a similar manner, the requirement that 'B' and 'C' Class Trade apprentices complete Grades Nine and Eight respectively was meaningless in terms of definitive standards since Queensland high school students have not been required to achieve a 'Pass' mark to progress from grade to grade since 1970.

SCHOOL RESULTS

Employers varied in the importance they gave to school results. In electrical fitter mechanics, fitting and machining, carpenters and joiners and motor mechanics employers looked for reasonable passes ('4' or more in Advanced Mathematics, Science and English).

The apprentice master who worked at a specialized electrical firm looked for at least a '5' in Junior English, believing a good grasp of English was essential in reading technical literature. A good pass in Technical Drawing was also an advantage in most of the above listed trades since technical drawing constituted much of the reading he had to do at college. A number of employers expressed their concern about applicants needing a reasonable level of literacy and numeracy in order to pass their college courses even though these skills may not have been required on the job.

Hairdressers, painters and cooks were concerned with school results only in so far as they were a reflection of the applicant's personality, for example, did results indicate that he was a 'hard worker'?

LETTER OF APPLICATION/APPLICATION FORM

The letter of application, or application form submitted by those applying for apprenticeship was usually the first contact an employer had with an applicant. As such, the quality of the letter (presentation, handwriting and spelling) was crucial. Although there may be little writing involved on the job, a carefully written, correctly spelt application was, as one employer put it, an indication that the applicant "had tried". Employers were interested in an applicant whose letter or answers to questions on the application form expressed an interest in and commitment to the trade, clearly an applicant with writing skills would be able to express this more succinctly than an applicant who lacked these skills.

A number of application forms required applicants to write down details of their interests, hobbies, even their "future ambitions". Here again, employers were looking for an applicant who stood out as having drive and motivation; however, it is not difficult to envisage the situation in which a capable and well motivated applicant would not be interviewed simply because he lacked ability to express himself adequately in his written application.

THE INTERVIEW

Most successful applicants for apprenticeships had been interviewed at least once. Employers were impressed by applicants who could express themselves clearly and some enthusiasm for the trade. Some employers took applicants for work shop tours and noted how observant and interested they were. Thus the interview situation placed considerable demands on the applicant's oral language skills. The applicant who was confident in talking with and asking questions of, someone outside his immediate peer group was clearly at an advantage.

This was particularly true in the selection of hairdressing apprentices, employers were looking for applicants who could communicate warmly and effectively.

TESTING

In some firms (usually larger companies with a commitment to training), psychological tests were used to assess the suitability of applicants for apprenticeship; they ranged from tests of general reasoning ability, for example, the 'Otis', and tests of mechanical reasoning to personality tests designed to gauge the applicant's level of commitment to the trade. All these tests made literacy demands on the applicant since all questions to be answered had to be read. In the 'Otis' applicants were expected to answer quite complex verbal comprehension questions, these demanded a high level of literacy. Tests of mechanical reasoning required a fairly high standard of numeracy.

In summary, the selection processes did place literacy and numeracy demands on the applicant for apprenticeship:-

1. in it expected of him English and Mathematics at Junior level;
2. in the Psychological tests which some firms required the applicant to undergo;
3. in the interview situation where an applicant able to communicate effectively and enthusiastically was an obvious advantage.

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LITERACY AND NUMERACY DEMANDS
ON
SCHOOL LEAVERS ENTERING
SELECTED APPRENTICESHIPS
IN
QUEENSLAND, AUSTRALIA.

VOLUME II

APPENDICES

A. MORRIS and R.G. COPE

APPENDIX 'A'

I. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document 1. (a)	S.E.Q.E.B. Requisition Form
Document 1. (b)	*Australian Standard 3,000* Part 1.(1976) *S.A.A. Wiring Rules* Sydney: Standards Association of Australia.
Document 1. (c)	Notes on how to install water heating systems.
Document 1. (d)	Standard Instructions on 11 kv Transformers (S.E.Q.E.B. publication)
Document 1. (e)	Trouble Shooting Chart
Document 1. (f)	Circuit Diagrams

LITERACY AT COLLEGE

Document 1. (g)	Jenneson, J.R. (1980) *Electrical Principles for the Electrical Trades.* Sydney: McGraw Hill.
Document 1. (h)	Pethebridge, K., Williams, W. (1977) *Australian Electrical Wiring: Theory and Practice.* Sydney: McGraw Hill.
Document 1. (i)	Queensland Department of Technical and Further Education (T.A.F.E.) *Electrical Section Notes.*

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

LIST OF READING MATERIALS.

Document 1. (a)	REQUISITION FOR SERVICES OR MATERIALS.
Purpose	Job Allocation.
Description [1]	N/a
Readability Estimate [2]	N/a

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[1] Description from Sticht (1970) definition of "Content Type Categories".

[2] Readability estimated using 'FORCAST' formulae, Sticht.

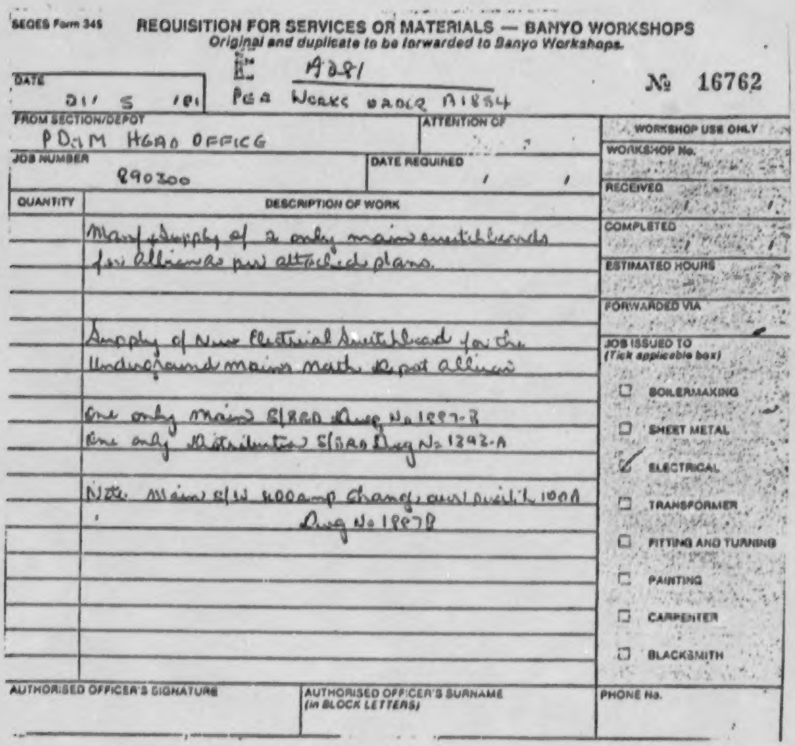
APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

Document 1 (a) REQUISITION FOR SERVICES OR MATERIALS (continued)

Sample



SEQES Form 345

REQUISITION FOR SERVICES OR MATERIALS — BANYO WORKSHOPS

Original and duplicate to be forwarded to Banyo Workshops.

E 4281

PER WORKS ORDER A1884

№ 16762

DATE 21/ 5 /81

FROM SECTION/DEPOT PDoM HEAD OFFICE

ATTENTION OF

JOB NUMBER 890300

DATE REQUIRED / /

QUANTITY	DESCRIPTION OF WORK
	Manuf & Supply of 2 only mains switchboards
	for Allinson per attached plans.
	Supply of New Electrical Switchboard for the
	Underground mains Math Depot Allinson
	One only Mains S/BRD Dwg No 1887-B
	One only Distribution S/BRD Dwg No 1393-A
	Note Mains S/W 400amp Change over switch 100A
	Dwg No 1887B

WORKSHOP USE ONLY

WORKSHOP No.

RECEIVED / /

COMPLETED / /

ESTIMATED HOURS

FORWARDED VIA

JOB ISSUED TO
(Tick applicable box)

☐ BOILERMAKING
☐ SHEET METAL
☑ ELECTRICAL
☐ TRANSFORMER
☐ FITTING AND TURNING
☐ PAINTING
☐ CARPENTER
☐ BLACKSMITH

AUTHORISED OFFICER'S SIGNATURE

AUTHORISED OFFICER'S SURNAME (in BLOCK LETTERS)

PHONE No.

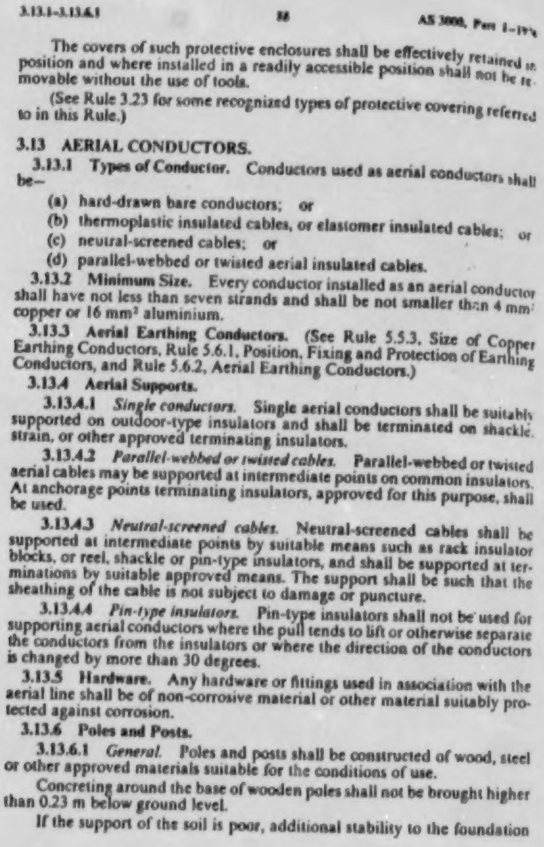
APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

Document 1. (b)	*Australian Standard 3,000* Part I. *S.A.A. Wiring Rules.*
Purpose	Detailed Job Instruction
Description	Standards and Specifications
Readability Level	11.8

Sample



3.13.1–3.13.6.1 88 AS 3000, Part 1–19

The covers of such protective enclosures shall be effectively retained in position and where installed in a readily accessible position shall not be removable without the use of tools.

(See Rule 3.23 for some recognized types of protective covering referred to in this Rule.)

3.13 AERIAL CONDUCTORS.

3.13.1 Types of Conductor. Conductors used as aerial conductors shall be–

(a) hard-drawn bare conductors; or
(b) thermoplastic insulated cables, or elastomer insulated cables; or
(c) neutral-screened cables; or
(d) parallel-webbed or twisted aerial insulated cables.

3.13.2 Minimum Size. Every conductor installed as an aerial conductor shall have not less than seven strands and shall be not smaller than 4 mm^2 copper or 16 mm^2 aluminium.

3.13.3 Aerial Earthing Conductors. (See Rule 5.5.3, Size of Copper Earthing Conductors, Rule 5.6.1, Position, Fixing and Protection of Earthing Conductors, and Rule 5.6.2, Aerial Earthing Conductors.)

3.13.4 Aerial Supports.

3.13.4.1 *Single conductors.* Single aerial conductors shall be suitably supported on outdoor-type insulators and shall be terminated on shackle, strain, or other approved terminating insulators.

3.13.4.2 *Parallel-webbed or twisted cables.* Parallel-webbed or twisted aerial cables may be supported at intermediate points on common insulators. At anchorage points terminating insulators, approved for this purpose, shall be used.

3.13.4.3 *Neutral-screened cables.* Neutral-screened cables shall be supported at intermediate points by suitable means such as rack insulator blocks, or reel, shackle or pin-type insulators, and shall be supported at terminations by suitable approved means. The support shall be such that the sheathing of the cable is not subject to damage or puncture.

3.13.4.4 *Pin-type insulators.* Pin-type insulators shall not be used for supporting aerial conductors where the pull tends to lift or otherwise separate the conductors from the insulators or where the direction of the conductors is changed by more than 30 degrees.

3.13.5 Hardware. Any hardware or fittings used in association with the aerial line shall be of non-corrosive material or other material suitably protected against corrosion.

3.13.6 Poles and Posts.

3.13.6.1 *General.* Poles and posts shall be constructed of wood, steel or other approved materials suitable for the conditions of use.

Concreting around the base of wooden poles shall not be brought higher than 0.23 m below ground level.

If the support of the soil is poor, additional stability to the foundation

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

Document 1. (b) *Australian Standard 3,000* Part 1.

S.A.A. Wiring Rules. (continued)

Sample

TABLE B6

CURRENT RATINGS FOR SINGLE-CORE 0.6/1 kV INSULATED AND SHEATHED NON-ARMOURED CABLES

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Cable size	Current rating, A												Three-phase voltage drop* mV/A.m	
	Unenclosed				Buried direct in ground				Single-way underground ducts					
	R75, V75 + V90		XLPE, R-EP-90, R-CSP-90		R75, V75 + V90		XLPE, R-EP-90, R-CSP-90		R75, V75 + V90		XLPE, R-EP-90, R-CSP-90			
mm²	Copper	Alum.	Copper	Alum.	Copper	Alum.	Copper	Alum.	Copper	Alum.	Copper	Alum.	Copper	Alum.
1	16	–	19	–	23	–	26	–	19	–	23	–	40	–
1.5	19	–	23	–	28	–	32	–	24	–	28	–	27	–
2.5	27	–	32	–	37	–	41	–	32	–	38	–	16	–
4	36	–	43	–	48	–	54	–	41	–	49	–	10	–
6	46	32	54	39	60	43	67	48	51	36	61	44	6.8	11
10	62	44	76	54	81	58	90	65	69	50	82	59	4.0	6.7
16	83	60	100	72	105	76	115	83	89	64	105	76	2.6	4.2
25	110	80	135	94	135	97	155	110	115	83	145	105	1.6	2.7
35	140	100	165	120	160	115	180	130	140	100	170	120	1.2	1.9
50	180	130	210	160	190	140	215	165	195	145	200	155	0.86	1.4
70	230	165	265	205	230	175	265	205	235	180	250	190	0.61	0.98
95	280	205	320	250	280	215	310	240	285	215	295	230	0.47	0.74
120	320	240	390	300	315	240	360	280	320	245	340	265	0.38	0.58
150	370	270	440	345	355	270	400	315	360	275	400	300	0.33	0.48
185	435	320	510	400	400	310	455	355	405	310	440	340	0.28	0.40
240	510	385	600	470	465	355	530	415	470	360	510	400	0.24	0.32
300	600	440	700	545	520	405	600	470	530	410	580	450	0.21	0.27
400	680	520	810	645	600	475	670	540	600	465	650	510	0.20	0.24
500	790	610	935	745	660	530	750	610	680	520	730	580	0.18	0.21
630	900	711	1080	880	740	610	840	690	770	600	810	660	0.17	0.19

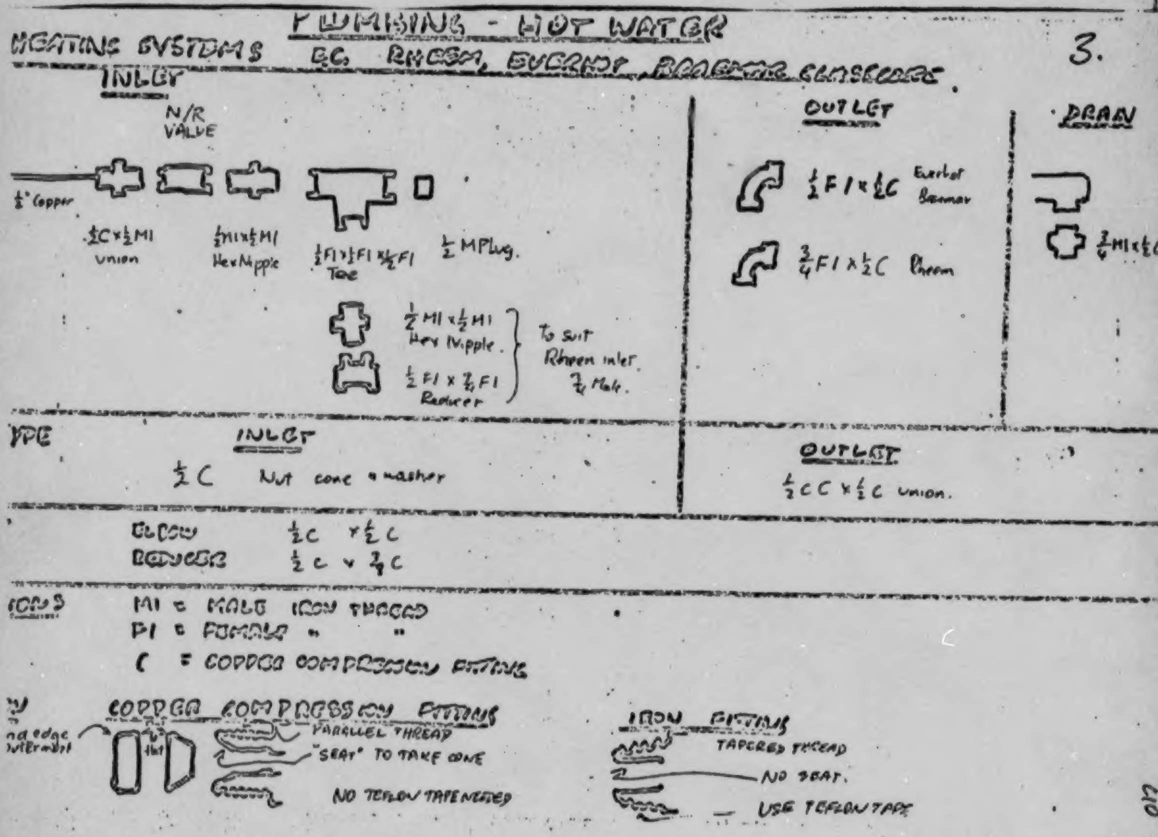
* For single-phase voltage drops multiply the three-phase value by 1.155

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

Document 1. (c)	Notes on Installation of Water Heating Systems.
Purpose	Detailed Job Description
Description	Procedural Checkpoints
Readability Level	N/a
Sample	



PLUMBING - HOT WATER

HEATING SYSTEMS EG. RHEEM, EVERHOT, BRAEMAR, GLASSCOTE.

3.

INLET

N/R VALVE

$\frac{1}{2}$" Copper

$\frac{1}{2}$C x $\frac{1}{2}$MI union

$\frac{1}{2}$MI x $\frac{1}{2}$MI Hex Nipple

$\frac{1}{2}$FI x $\frac{1}{2}$FI x $\frac{1}{2}$FI Tee

$\frac{1}{2}$ MPlug.

$\frac{1}{2}$ MI x $\frac{1}{2}$ MI Hex Nipple.

$\frac{1}{2}$ FI x $\frac{3}{4}$ FI Reducer

To suit Rheem inlet $\frac{3}{4}$ Male.

OUTLET

$\frac{1}{2}$FI x $\frac{1}{2}$C Everhot Braemar

$\frac{3}{4}$FI x $\frac{1}{2}$C Rheem

DRAIN

$\frac{3}{4}$MI x $\frac{1}{2}$

YPE

INLET

$\frac{1}{2}$C Nut cone & washer

OUTLET

$\frac{1}{2}$CC x $\frac{1}{2}$C union.

ELBOW $\frac{1}{2}$C x $\frac{1}{2}$C

REDUCER $\frac{1}{2}$C x $\frac{3}{4}$C

IONS

MI = MALE IRON THREAD

FI = FEMALE " "

C = COPPER COMPRESSION FITTING

nd edge internal

COPPER COMPRESSION FITTING

PARALLEL THREAD

"SEAT" TO TAKE CONE

NO TEFLON TAPE NEEDED

IRON FITTING

TAPERED THREAD

NO SEAT.

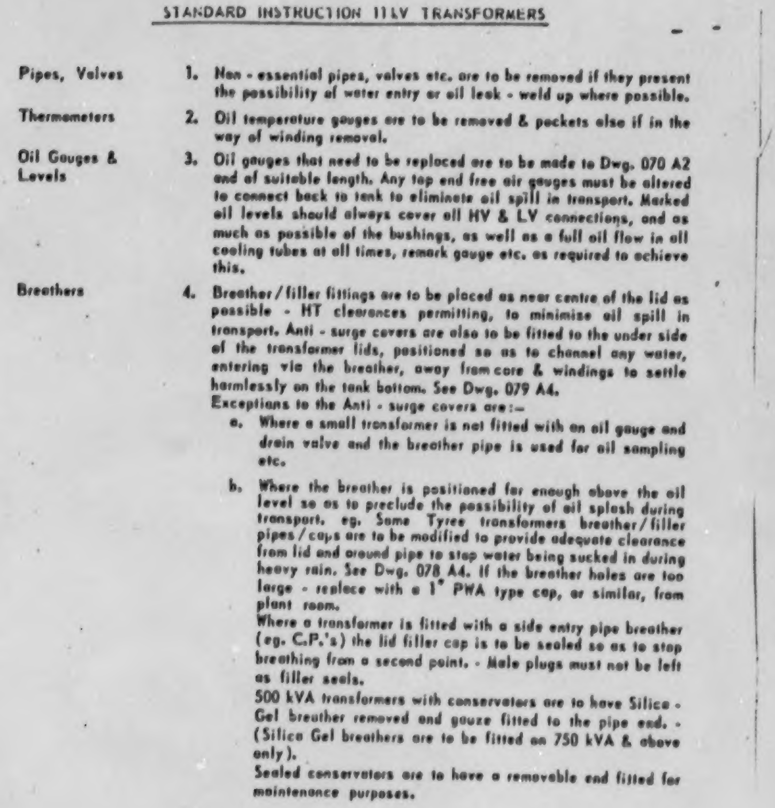
USE TEFLON TAPE

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANIC

LITERACY ON THE JOB

Document 1. (d)	Standard Instructions on 11 kv Transformers (S.E.Q.E.B. publication)
Purpose	Detailed Job Description
Description	Functional Description
Readability Level	10.9



STANDARD INSTRUCTION 11kV TRANSFORMERS

Pipes, Valves

1. Non - essential pipes, valves etc. are to be removed if they present the possibility of water entry or oil leak - weld up where possible.

Thermometers

2. Oil temperature gauges are to be removed & pockets also if in the way of winding removal.

Oil Gauges & Levels

3. Oil gauges that need to be replaced are to be made to Dwg. 070 A2 and of suitable length. Any top end free air gauges must be altered to connect back to tank to eliminate oil spill in transport. Marked oil levels should always cover all HV & LV connections, and as much as possible of the bushings, as well as a full oil flow in all cooling tubes at all times, remark gauge etc. as required to achieve this.

Breathers

4. Breather / filler fittings are to be placed as near centre of the lid as possible - HT clearances permitting, to minimise oil spill in transport. Anti - surge covers are also to be fitted to the under side of the transformer lids, positioned so as to channel any water, entering via the breather, away from core & windings to settle harmlessly on the tank bottom. See Dwg. 079 A4.
   Exceptions to the Anti - surge covers are:–
   a. Where a small transformer is not fitted with an oil gauge and drain valve and the breather pipe is used for oil sampling etc.
   b. Where the breather is positioned far enough above the oil level so as to preclude the possibility of oil splash during transport. eg. Some Tyree transformers breather / filler pipes / caps are to be modified to provide adequate clearance from lid and around pipe to stop water being sucked in during heavy rain. See Dwg. 078 A4. If the breather holes are too large - replace with a 1" PWA type cap, or similar, from plant room.

   Where a transformer is fitted with a side entry pipe breather (eg. C.P.'s) the lid filler cap is to be sealed so as to stop breathing from a second point. - Male plugs must not be left as filler seals.

   500 kVA transformers with conservators are to have Silica - Gel breather removed and gauze fitted to the pipe end. - (Silica Gel breathers are to be fitted on 750 kVA & above only).

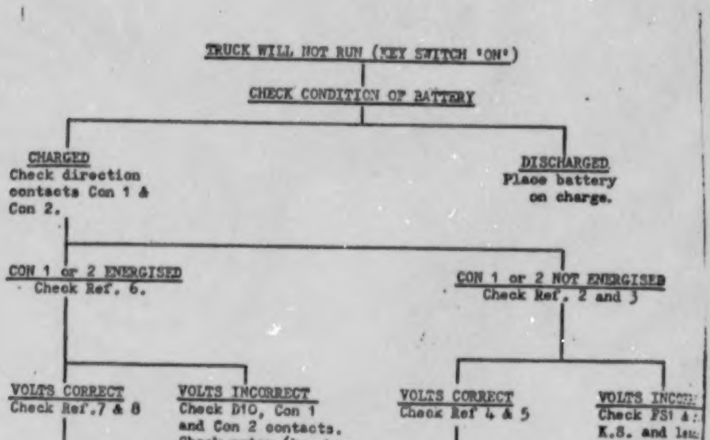
   Sealed conservators are to have a removable end fitted for maintenance purposes.

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

Document 1. (e)	Trouble Shooting Chart
Purpose	Problem Solving
Description	Procedural Checkpoints
Readability Level	N/a
Sample	

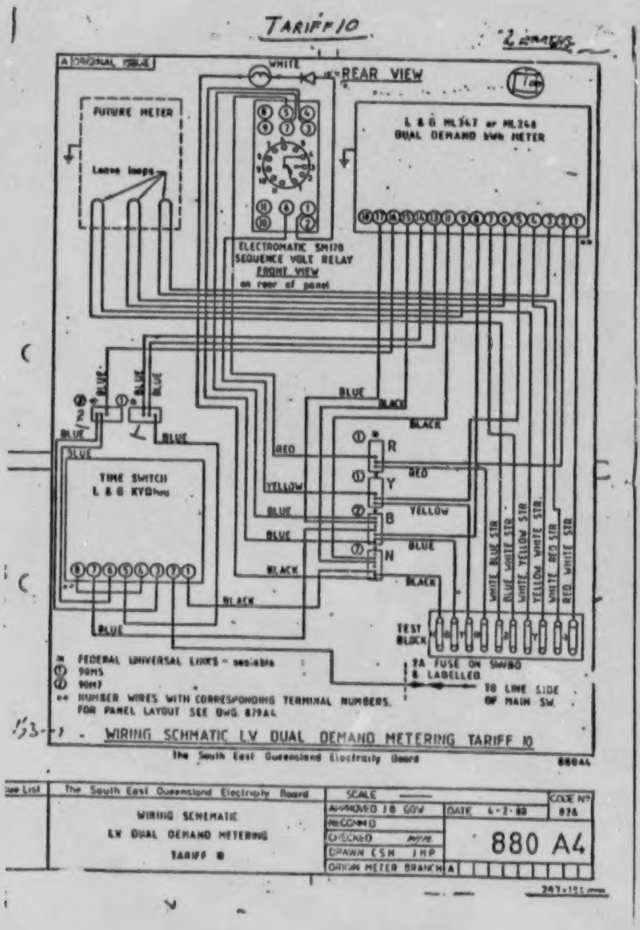

TRUCK WILL NOT RUN (KEY SWITCH 'ON')
CHECK CONDITION OF BATTERY
CHARGED
Check direction contacts Con 1 & Con 2.
DISCHARGED
Place battery on charge.
CON 1 or 2 ENERGISED
Check Ref. 6.
CON 1 or 2 NOT ENERGISED
Check Ref. 2 and 3
VOLTS CORRECT
Check Ref.7 & 8
VOLTS INCORRECT
Check D10, Con 1 and Con 2 contacts. Check motor (brushes etc.)
VOLTS CORRECT
Check Ref 4 & 5
VOLTS INC
Check FS1 &
K.S. and le
VOLTS CORRECT
Check Ref. 9
VOLTS INCORRECT
Fit new board 2004238 if point 8 still low, fit new board 2004237
VOLTS CORRECT
Check FS4, RL1 MS3, Con 1 and Con 2 coils.
VOLTS INC
Check MS1,
reversing s
and associ
leads.
VOLTS CORRECT
Check Ref. 11
VOLTS INCORRECT
Check printed circuit point 'A'. If correct, fit new board 2004239/2.
VOLTS CORRECT
Check Ref. 12
VOLTS INCORRECT
Check RH1 and associated wiring. If correct, fit new board 2004239/2
VOLTS CORRECT
Check Ref. 15
VOLTS INCORRECT
Fit new board 2004239/2 or 2004237.

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

Document 1. (f)	Circuit Diagrams
Purpose	Problem Solving
Description	Technical Drawings (Sticht's terminology does not apply)
Readability Level	
Sample	



APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY AT COLLEGE

Document 1. (g)	Jenneson, V.R. (1980) *Electrical Principles for the Electrical Trades*
Purpose	College Text
Description	Theory
Readability Estimate	11.5
Sample	

Table 2.7 *Preferred range of resistor values*

20% tolerance	10% tolerance	5% tolerance
10	10	10
		11
	12	12
		13
15	15	15
		16
	18	18
		20
22	22	22
		24
	27	27
		30
33	33	33
		36
	39	39
		43
47	47	47
		51
	56	56
		62
68	68	68
		75
	82	82
		91

2.16 Temperature-dependent resistors

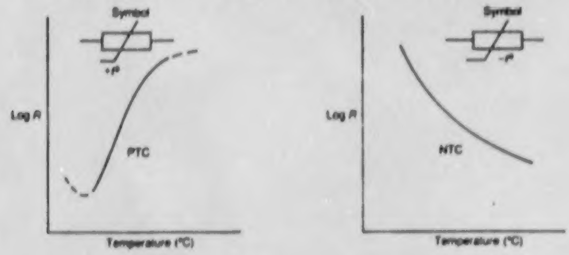
It was shown in Section 2.13.4 that conductor resistance is affected by temperature. The rising or falling characteristic can be used to advantage in electrical circuits. Where the temperature of a circuit or device rises, the change in resistance is used to alter the circuit's behaviour to compensate for the temperature change. With electrical machinery, the resistors can switch the power off if temperatures shift outside a specified range.

2.16.1 *Positive temperature coefficients* (PTC)
Metals generally have a positive temperature coefficient of resistance, but a PTC resistor is one in which the change in resistance is greatly increased over that of a normal conductor. Two main materials are used. One is a metallic oxide such as barium oxide, which has a large PTC over a limited range, the other is silicon based with a smaller PTC over a larger range. The typical shaped characteristic is shown in Figure 2.18(a).

2.16.2 *Negative temperature coefficients* (NTC)
NTC resistors are made from oxides of chromium or nickel which have been modified by the addition of small amounts of semiconductor material.

The characteristic is shown in Figure 2.18(b).

2.16.3 *Low temperature coefficients*
In some circumstances a resistor is required to retain its value over a range of temperatures. Special alloys have been developed for this purpose, one of which is manganin. In Table 2.5 its temperature coefficient is given as 0.000 01. Its resistance change is so small in comparison to metallic elements generally that it is often listed as zero. Manganin is used where resistors of high temperature stability are required, as in measuring instruments.



(a) (b)

Fig. 2.18 Temperature dependent resistors

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY AT COLLEGE

Document 1. (h)	Pethebridge, K., Williams, W. (1977) *Australian Electrical Wiring: Theory and Practice.*
Purpose	College Text
Description	Theory Standards and Specifications
Readability Estimate	11.8

Sample.

EARTHING SYSTEMS 249

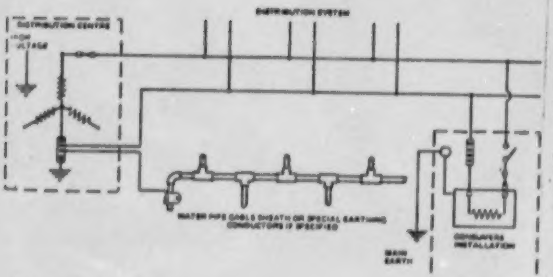


Fig. 10.4 Direct Earthing System

Electricity Authority of NSW

supply system through the bond connection to the earth electrode on the MEN System or the neutral main.

In the **Direct Earthing System** (Fig. 10.4), the code specifies a connection to (a) the metallic water supply system or (b) an underground system of metallic cable sheaths or (c) a special earthing conductor.

Note that this is for the source of supply. The consumer's earthing arrangements are dealt with in Section 10.4.

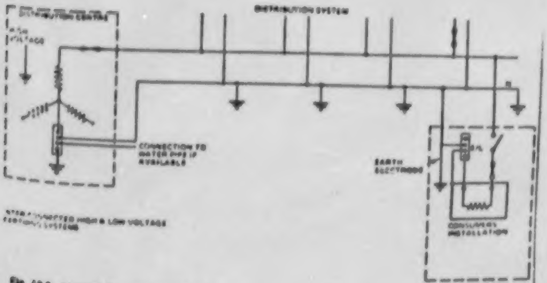


Fig 10.5 Multiple Earthed Neutral System

Electricity Authority of NSW

TYPES OF WIRING SYSTEMS AND ENCLOSURES 89

Rule 3.28.11 outlines the manner in which cables may be arranged within troughing, and states the limitations on the number of cables and the situations in which troughing may be installed.

Metal troughing systems are in common use in Australia and there are numerous designs which vary with different manufacturers, a typical example being overhead or wall troughing with a removable cover or lid. Wall troughing usually is fixed direct to the wall or supported on brackets, while overhead troughing is usually laid across roof trusses or supported by hanger brackets (see Fig. 5.3).

The usual trough section is rectangular. A full range of accessories such as couplings, elbows, tees and rising and falling elbows is always available for whatever make is used, provision being made along the run for "taking off", usually in the form of "knock-outs" at frequent intervals. A change in the wiring system, for example duct to conduit or TPS, may be made at these "knock-outs".

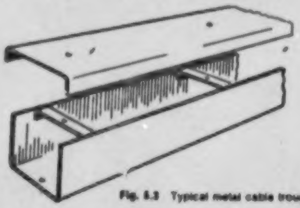


Fig. 5.3 Typical metal cable troughing

A variation in the system, illustrating its versatility, is the use of a small but structurally strong duct in a lighting system where the duct is also the support for the fluorescent luminaires (see Fig. 5.4).

Ducts may be divided into compartments, and if these provide approved segregation of wiring (see *Rule 1.11*) then services such as 240/415 V power and light, telephone systems, bell and signal and communication systems, may use separate compartments within the common duct.

Insulated ducts made of PVC or a similar nonconducting material are often used instead of metal, and these are similar to and about the same stock sizes as metal; however their mechanical strength is less than metal, and consequently they require more mechanical support. Accessories for the troughing are, of course, in the same material as the trough. The system formed is an all-insulated one, with no continuity problems with respect to earthing of the duct itself, but inclusion of earth wires in the system are still necessary for the earthing of exposed metal of accessories and appliances.

Heat dissipation, as in metal ducts, is still a problem and there are designs on the market that provide cooling by ventilation slots or holes.

Some manufacturers market troughing systems that are deliberately designed to be inconspicuous or to tie in with the general architectural scheme when installed. One of the most popular in this category is one which substitutes as a skirting board

APPENDIX 'A'

I. ELECTRICAL FITTER MECHANICS

LITERACY AT COLLEGE

Document I. (h)	Queensland Department of Technical and Further Education (T.A.F.E.) *Electrical Section Notes*
Purpose	College Notes
Description	Theory
Readability Estimate	10.1
Sample	

QUANTITY OF ELECTRICITY

The movement of free electrons is the basis of electric current in all applications. In order to measure and compare the quantities of charge flowing through different circuits, a unit of current must be derived.

Using the electron as the fundamental unit of charge. it would require a steady current of 2.5×10^{18} electrons to light a 240 V 100 W lamp for each second of operation. The electron, as a unit, is obviously too small for practical measuring purposes.

The Coulomb (Abbr. C) is a more useful unit. We should regard a coulomb a "bag" of electrons which passes a given point in an electrical circuit. This unit, in itself, is not the most effective measure, as it is the total number of electrons (6.3×10^{18}) or a quantity of electricity. It does not indicate a rate of flow, and it is the rate of flow which is the determining factor in the amount of heat generated in a light bulb, or heater, or appliance generally.

If we consider a Steady Current (i.e.) that rate of flow when the numbers of "bags" of charge pass a given point at the same rate, then if one coulomb passes in one second, one ampere of current is said to flow.

If Q coulombs pass a given point in the path in t seconds, then the current I amperes is given by the expression

$I = \frac{Q}{t}$ or Amperes = Coulombs per second.

Where I = steady current in amperes

Q = quantity of electricity, or electric charge in coulombs.

t = time taken in seconds for the transfer of the charge past a point in the circuit.

If one ampere of current flows for one second, the quantity of electricity moved is one coulomb.

$Q = It.$

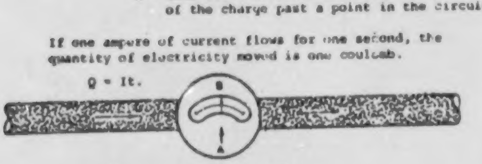


FIGURE 6.1

An Ammeter measures the total charge flowing past AB each second.

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

WRITING - COMPLETION OF FORMS

Document I. (a)	S.E.Q.E.B. Electrical Contractor's Report to the Consumer.
Document I. (b)	Kelvin Grove College of Advanced Education. Order Form
Document I. (c)	Time Sheet.
Document I. (d)	S.E.Q.E.B. Transformer File.

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

WRITING - COMPLETION OF FORMS

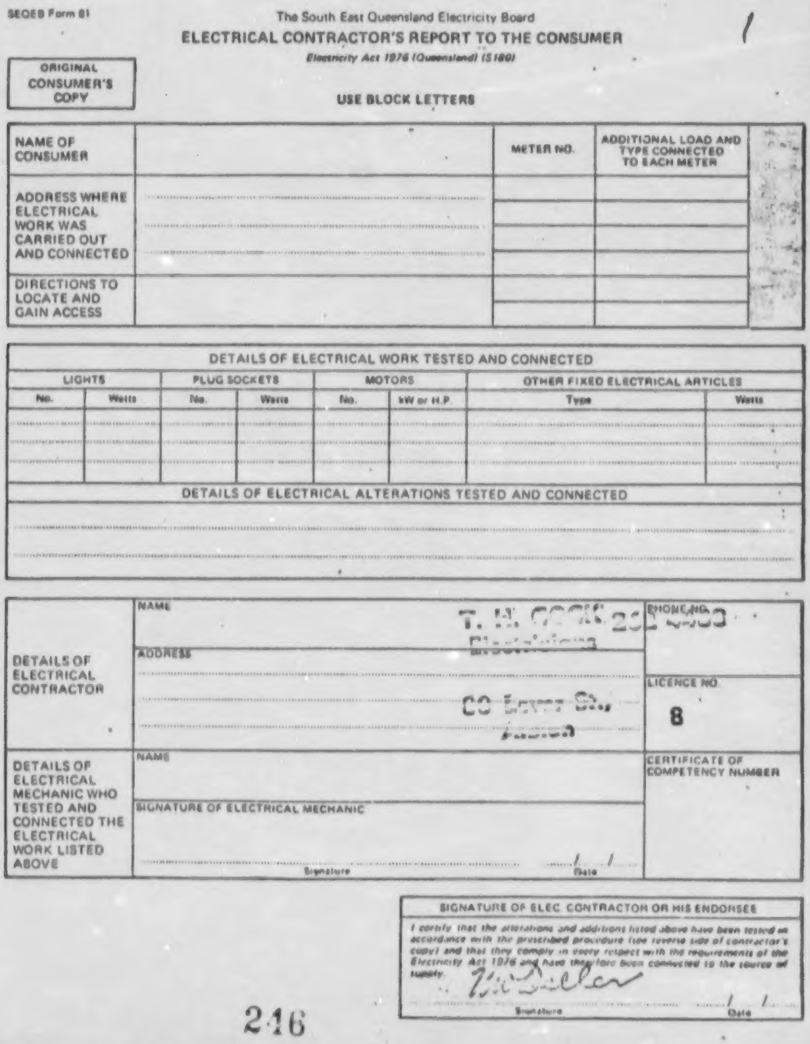
Document I. (a) S.E.Q.E.B. Electrical Contractor's Report to the Consumer.

Purpose

Description

Readability Estimate

Sample



SEQEB Form 81

The South East Queensland Electricity Board

ELECTRICAL CONTRACTOR'S REPORT TO THE CONSUMER

Electricity Act 1976 (Queensland) (S180)

1

ORIGINAL CONSUMER'S COPY

USE BLOCK LETTERS

NAME OF CONSUMER		METER NO.	ADDITIONAL LOAD AND TYPE CONNECTED TO EACH METER
ADDRESS WHERE ELECTRICAL WORK WAS CARRIED OUT AND CONNECTED			
DIRECTIONS TO LOCATE AND GAIN ACCESS			

DETAILS OF ELECTRICAL WORK TESTED AND CONNECTED

LIGHTS		PLUG SOCKETS		MOTORS		OTHER FIXED ELECTRICAL ARTICLES	
No.	Watts	No.	Watts	No.	kW or H.P.	Type	Watts

DETAILS OF ELECTRICAL ALTERATIONS TESTED AND CONNECTED

DETAILS OF ELECTRICAL CONTRACTOR	NAME T. H. COOK [illegible] Electricians	PHONE NO. [illegible]
	ADDRESS 60 [illegible] St., [illegible]	LICENCE NO. 8
DETAILS OF ELECTRICAL MECHANIC WHO TESTED AND CONNECTED THE ELECTRICAL WORK LISTED ABOVE	NAME	CERTIFICATE OF COMPETENCY NUMBER
	SIGNATURE OF ELECTRICAL MECHANIC Signature / / Date	

SIGNATURE OF ELEC. CONTRACTOR OR HIS ENDORSEE

I certify that the alterations and additions listed above have been tested in accordance with the prescribed procedure (see reverse side of contractor's copy) and that they comply in every respect with the requirements of the Electricity Act 1976 and have therefore been connected to the source of supply.

Signature / / Date

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

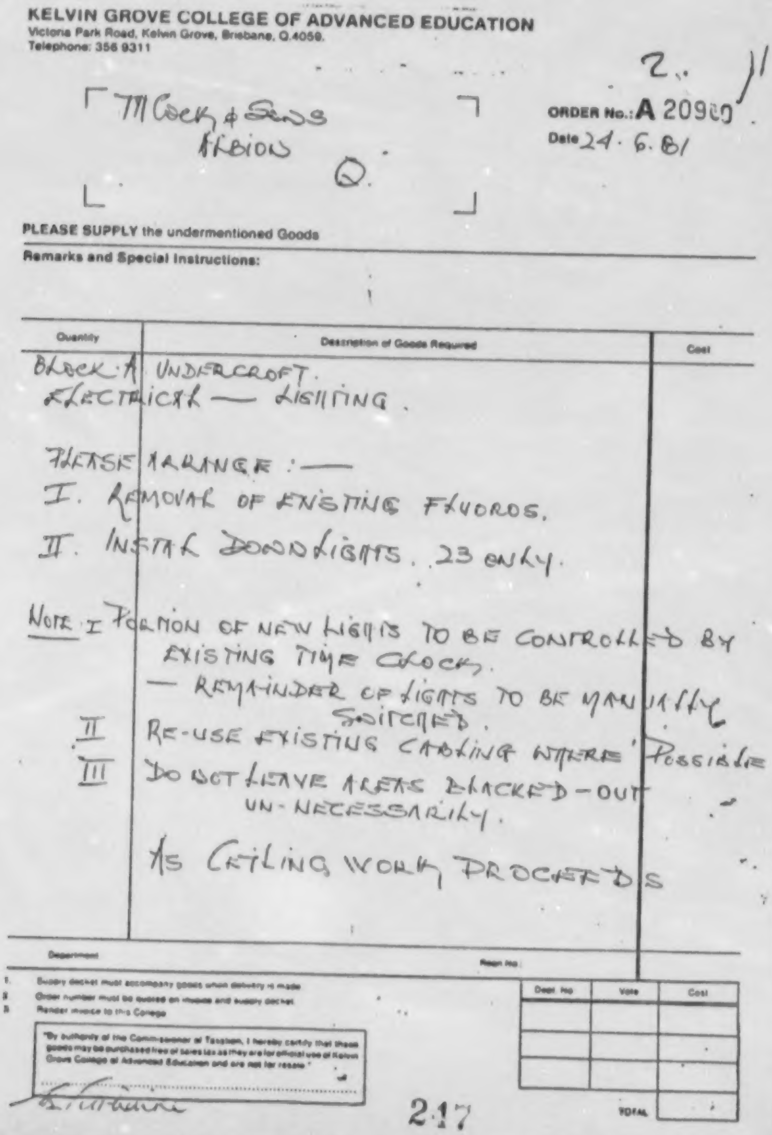
Document 1. (b) Kelvin Grove College of Advanced Education.

Purpose Order Form.

Description

Readability Estimate

Sample



KELVIN GROVE COLLEGE OF ADVANCED EDUCATION
Victoria Park Road, Kelvin Grove, Brisbane, Q.4059.
Telephone: 356 9311

2..

M Cock & Sons
Albion
Q.

ORDER No.: A 20900
Date 24.6.81

PLEASE SUPPLY the undermentioned Goods

Remarks and Special Instructions:

Quantity	Description of Goods Required	Cost

BLOCK A UNDERCROFT.
ELECTRICAL — LIGHTING.

PLEASE ARRANGE :—
I. REMOVAL OF EXISTING FLUOROS.
II. INSTAL DOWNLIGHTS. 23 ONLY.

NOTE I PORTION OF NEW LIGHTS TO BE CONTROLLED BY EXISTING TIME CLOCK.
— REMAINDER OF LIGHTS TO BE MANUALLY SWITCHED.
II RE-USE EXISTING CABLING WHERE POSSIBLE
III DO NOT LEAVE AREAS BLACKED-OUT UN-NECESSARILY.

AS CEILING WORK PROCEEDS

Department

Requn No:

1. Supply docket must accompany goods when delivery is made
2. Order number must be quoted on invoice and supply docket
3. Render invoice to this College

"By authority of the Commissioner of Taxation, I hereby certify that these goods may be purchased free of sales tax as they are for official use of Kelvin Grove College of Advanced Education and are not for resale."

Dept. No	Vote	Cost
	TOTAL	

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

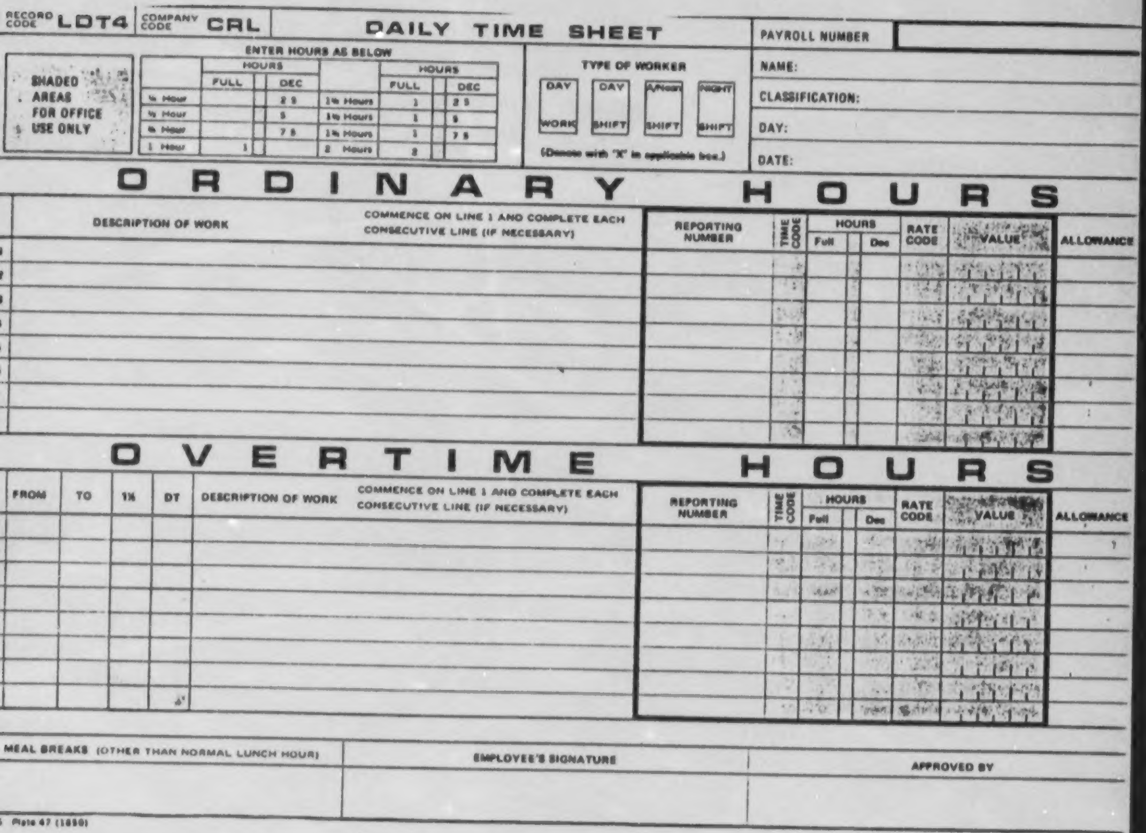
Document 1. (c) Time Sheet

Purpose

Description

Readability Estimate

Sample



RECORD CODE **LDT4** COMPANY CODE **CRL**

DAILY TIME SHEET

PAYROLL NUMBER

NAME:

CLASSIFICATION:

DAY:

DATE:

SHADED AREAS FOR OFFICE USE ONLY

ENTER HOURS AS BELOW

	HOURS FULL	DEC		HOURS FULL	DEC
¼ Hour		25	1¼ Hours	1	25
½ Hour		5	1½ Hours	1	5
¾ Hour		75	1¾ Hours	1	75
1 Hour	1		2 Hours	2	

TYPE OF WORKER

☐ DAY WORK ☐ DAY SHIFT ☐ A/Noon SHIFT ☐ NIGHT SHIFT

(Denote with "X" in applicable box.)

ORDINARY HOURS

COMMENCE ON LINE 1 AND COMPLETE EACH CONSECUTIVE LINE (IF NECESSARY)

DESCRIPTION OF WORK	REPORTING NUMBER	TIME CODE	HOURS Full	HOURS Dec	RATE CODE	VALUE	ALLOWANCE

OVERTIME HOURS

COMMENCE ON LINE 1 AND COMPLETE EACH CONSECUTIVE LINE (IF NECESSARY)

FROM	TO	1½	DT	DESCRIPTION OF WORK	REPORTING NUMBER	TIME CODE	HOURS Full	HOURS Dec	RATE CODE	VALUE	ALLOWANCE

MEAL BREAKS (OTHER THAN NORMAL LUNCH HOUR)	EMPLOYEE'S SIGNATURE	APPROVED BY

Plate 47 (1850)

APPENDIX 'A'

1. ELECTRICAL FITTER MECHANICS

LITERACY ON THE JOB

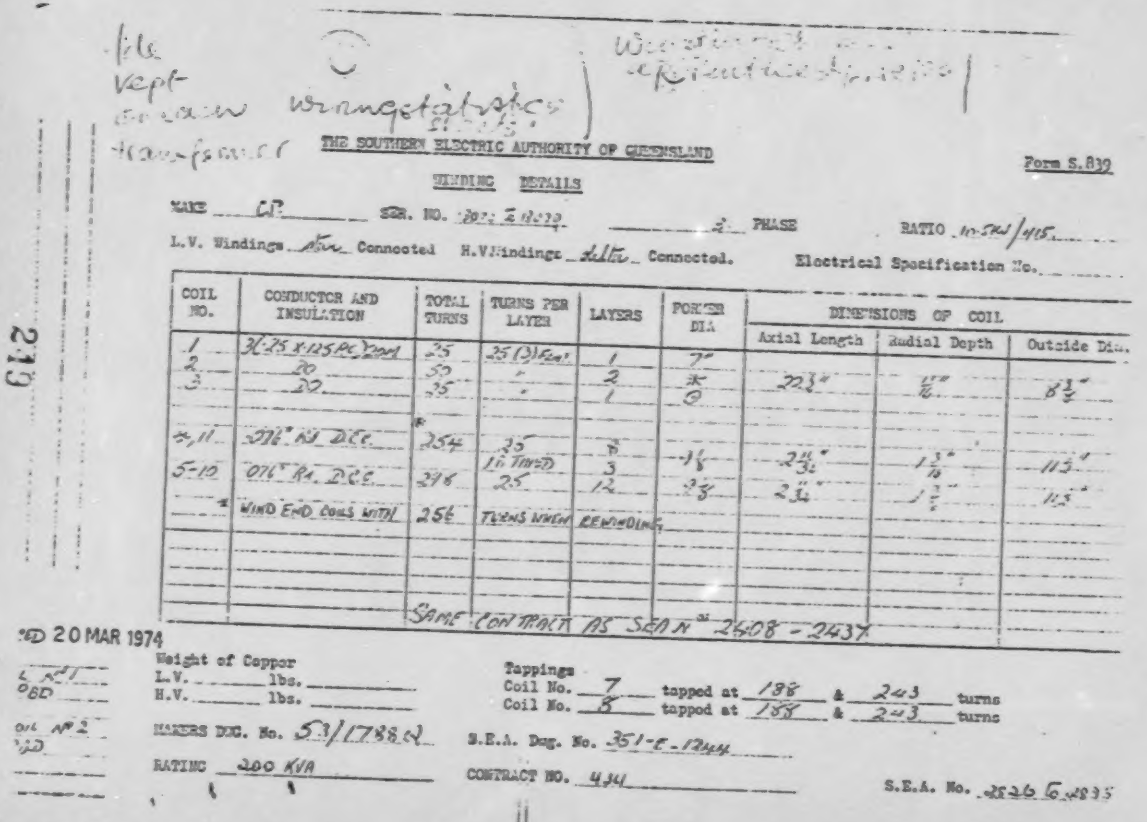
Document 1. (d) S.E.Q.E.B. Transformer File

Purpose

Description

Readability Estimate

Sample



file
kept
[illegible]
transformer

THE SOUTHERN ELECTRIC AUTHORITY OF QUEENSLAND

Form S.839

WINDING DETAILS

MAKE CP SER. NO. 3073 Z 18079 3 PHASE RATIO 10.5KV/415

L.V. Windings star Connected H.V. Windings delta Connected. Electrical Specification No.

COIL NO.	CONDUCTOR AND INSULATION	TOTAL TURNS	TURNS PER LAYER	LAYERS	FORMER DIA	DIMENSIONS OF COIL		
						Axial Length	Radial Depth	Outside Dia.
1	3(·25 x ·125 PC) [illegible]	25	25 (3) [illegible]	1	7"			
2	20	50	"	2	[illegible]	22¾"	15/16"	8½"
3	20	35	"	1	8			
4, 11	·076" RA DCC	254	25	8				
			(1 TAPED)	3	1⅛	2 11/32"	1 3/16"	11.5"
5-10	·076" RA. DCC	298	25	12	2⅜	2 11/32"	1 3/16"	11.5"
*	WIND END COILS WITH	256	TURNS WHEN	REWINDING				
		SAME CONTRACT AS SEA Nos 2408 - 2437						

RECD 20 MAR 1974

Weight of Copper
L.V. lbs.
H.V. lbs.

Tappings
Coil No. 7 tapped at 188 & 243 turns
Coil No. 8 tapped at 188 & 243 turns

MAKERS DWG. No. 53/17882

S.E.A. Dwg. No. 351-E-1244

RATING 200 KVA

CONTRACT NO. 434

S.E.A. No. 2526 & 2835

APPENDIX 'A'

II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II. (a)	Technical Drawings
Document II. (b)	Micrometer Vernier Caliper (Mitutoyo Mfg. Co. Ltd.)
Document II. (c)	Drill Tappet Charts
Document II. (d)	*Basic Trade Manual: Special Lathes* (1975). Canberra: Australian Government Publishing Service.
Document II. (e)	Metric Conversion Chart

LITERACY AT COLLEGE

Document II. (f)	Queensland Department of Technical and Further Education (T.A.F.E.) *Fitting and Machining Notes.*
Document II. (g)	Education Department of Victoria, Technical Schools Division (1979) *Fitting and Machining 1, 2, 3.* Victoria: Wilke & Co. Ltd.

II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS - TRADE JOURNALS

Machinery and Production

Engineering

Ball Bearing (Skf)

Compressed Air

Power

Tooling

Machinery

Steam

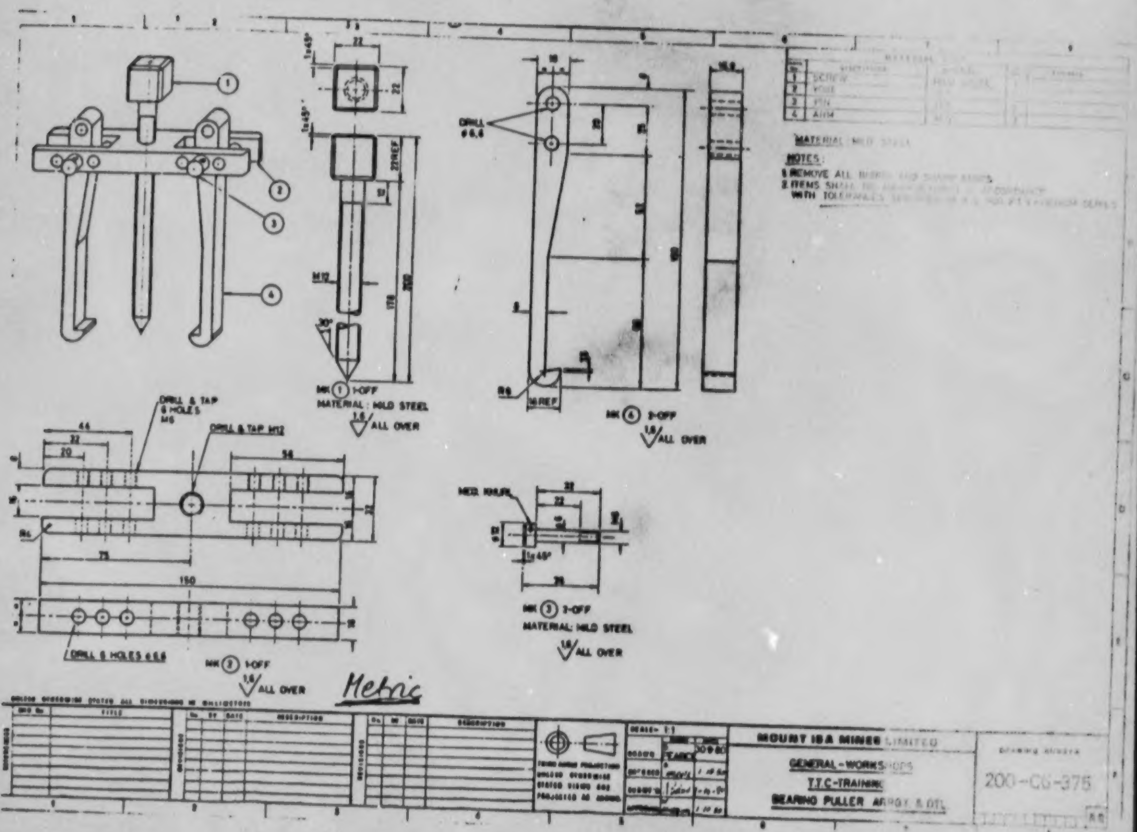
.II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II. (a)	Technical Drawing Mount Isa Mines T.T.C. - Training Bearing Puller Arrgt. & Dtl.
Purpose	Detailed Job Instruction
Description	Technical drawing.
Readability Estimate	N/a

Sample



APPENDIX 'A'

II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II . (b)	Micrometer Vernier Caliper Mitutoyo Mfg. Co. Ltd.
Purpose	Manufacturer's Instructions
Description	Procedural Directions
Readability Estimate	11.3

Sample

1 Graduations on vernier scale

Graduations of vernier scale is usually obtained by equally dividing (n-1) graduations of main scale into n parts.

1-1 Graduation method

JIS B7507 specifies the graduation method as follows:

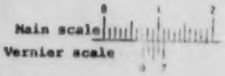
The minimum division on main scale (mm)	Graduation method for vernier scale	The minimum reading (mm)
0.5	12mm equally divided into 25 parts 24.5mm equally divided into 25 parts	0.02 = 1/50
1	49mm equally divided into 50 parts	
	19mm equally divided into 20 parts 39mm equally divided into 20 parts	0.05 = 1/20

1-2 Reading vernier scale

1) 0.05mm vernier scale

Main scale	7 mm
Vernier scale	0.2mm (0.05 x 4)
Total	7.2mm

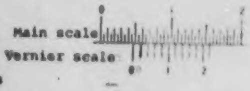
The 4th vernier scale coincides with a main scale graduation.



2) 0.02mm vernier scale

Main scale	4.5mm
Vernier scale	0.22mm(0.02 x 11)
Total	4.72mm

The 11th vernier scale coincides with a main scale graduation.



II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

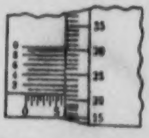
Document II. (b) Micrometer Vernier Caliper (continued)

Sample (continued)

2 Outside Micrometer with special feature

2-1 Micrometer with vernier scale

The standard micrometer with the vernier scale on the sleeve can be read to 0.001mm (Fig. 2.1) In this micrometer, reading to 0.01mm is made on the thimble as in the case of the standard micrometer.
In reading of vernier scale, find which graduation of the vernier scale coincides with that of the thimble and multiply it by 0.001mm.



Sleevp: 6mm
Thimble: 0.21mm
Vernier: 0.003mm
Total 6.213mm

Fig. 2.1

2-2 Micron Micrometer (Amplification by cam mechanism)

This micrometer has two-part thimble: one part, the inner thimble, is graduated in 0.01mm, and the other, outer thimble, is graduated in 0.001mm. A revolution of the outer thimble by 10 divisions causes the inner thimble to rotate by 1 division, providing the minimum reading of 0.001mm on the outer thimble.

Photo 2.1 Micron Micrometer

2-3 Micron Micrometer with non-rotating spindle

This micrometer has a flush fitted vernier scale to provide the minimum reading of 0.001mm without parallax error.
Furthermore, this micrometer features a non-rotating spindle of 8mm dia. which produces no torsion on a work to be measured, providing a reliable measurement. The ratchet mechanism is built in the thimble.

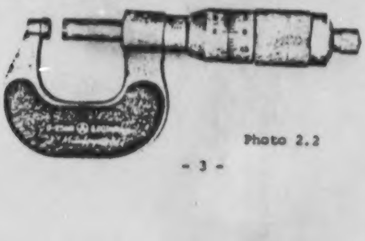


Photo 2.2

II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II. (b) Micrometer Vernier Caliper(continued)

Sample (continued)

2 Types of Vernier Caliper

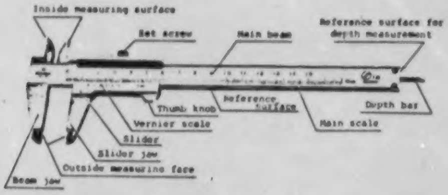
2-1 Vernier scale under JIS

2-1.1 M type Vernier Caliper

There are two models for M type: M1 type which has not fine-feeding device, and M2 type which is equipped with slider fine-feeding device.

a) M1 type Vernier Caliper

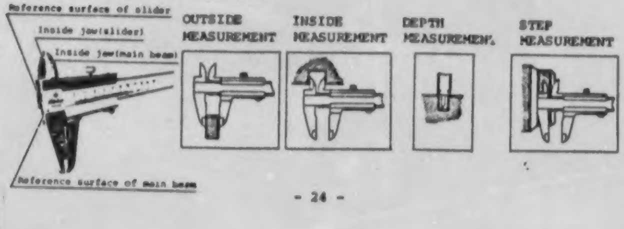
a-1) Standard type



The construction of standard type of vernier caliper is illustrated as above. The depth bar is furnished to the vernier caliper of range up to 300mm. 600mm and 1000mm vernier calipers of this type are without the depth bar. Inside measuring jaws are furnished separately from the outside measuring jaws.

- * Vernier scale of 0.05mm (19mm is equally divided into 20 parts) reading is employed up to 300mm vernier caliper.

Mitutoyo M1 type standard vernier caliper is referred to as SD type because of its added feature: the inside jaws are located near to the edge of the main scale, and both edges of main beam and slider are on the same plane at zero reading of the scales.
Because of this feature MITUTOYO SD type vernier caliper allows step measurement in addition to outside, inside and depth measurements.



APPENDIX 'A'

II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II. (c)	Drill Tappett Charts
Purpose	Detailed Job Instructions
Description	Standards and Specifications
Readability Estimate	N/a

Sample

Dia.	Tapping		Clearance
	U.N.C. Coarse	U.N.F. Fine	
0	-	3/64"	1/16"
1	1.45 mm	1.50 mm	1.95 mm
2	1.70 mm	1.80 mm	2.25 mm
3	5/64"	2.05 mm	2.60 mm
4	2.20 mm	2.30 mm	2.95 mm
5	2.55 mm	2.60 mm	3.30 mm
6	2.70 mm	2.90 mm	9/64"
8	3.40 mm	3.50 mm	4.30 mm
10	3.80 mm	4.00 mm	4.90 mm
12	4.40 mm	4.60 mm	5.60 mm
1/4"	13/64"	5.40 mm	6.50 mm
5/16"	6.50 mm	6.90 mm	8.20 mm
3/8"	5/16"	8.50 mm	9.80 mm
7/16"	9.30 mm	25/64"	29.64"
1/2"	27/64"	29/64"	33/64"
9/16"	31/64"	13.00 mm	37/64"
5/8"	17/32"	14.50 mm	41/64"
3/4"	16.50 mm	11/16"	49/64"
7/8"	49/64"	20.50 mm	57/64"
1"	7/8"	23.50 mm	1.1/64"

Dia.	Tapping	Clearance
	mm	mm
M 1	0.78	1.1
M 1.1	0.88	1.2
M 1.2	0.98	1.3
M 1.4	1.15	1.5
M 1.6	1.3	1.7
M 1.8	1.5	1.9
M 2	1.65	2.2
M 2.2	1.8	2.4
M 2.5	2.1	2.7
M 3	2.55	3.2
M 3.5	2.95	3.7
M 4	3.4	4.3
M 4.5	3.8	4.8
M 5	4.3	5.3
M 6	5.1	6.4
M 7	6.1	7.4
M 8	6.9	8.4
M 9	7.9	9.4
M 10	8.6	10.5
M 11	9.6	11.5
M 12	10.4	13.0
M 14	12.2	15.0
M 16	14.25	17.0
M 18	15.75	19.0
M 20	17.75	21.0

Dia.	Tapping	Clearance
	mm	mm
M 22	19.75	23.0
M 24	21.25	25.0
M 27	24.25	28.0
M 30	27.0	31.0
M 33	30.0	34.0
M 36	32.5	37.0
M 39	35.5	40.0
M 42	38.0	43.0
M 45	41.0	46.0
M 56	51.0	58.0
M 60	55.0	62.0
M 64	58.0	64.0
M 68	62.0	70.0

There are also ISO METRIC FINE PITCH THREADS but as these are many and varied, rather than present in table form it is suggested that the tapping drill is derived as follows:
Tapping Drill = Outside dia - pitch
eg. 4.0 mm dia .05 mm pitch
Tapping Drill = 4.0 - 0.5 = 3.5 mm
Clearance Drills as per table for COARSE PITCH THREADS

II. FITTING AND MACHINING

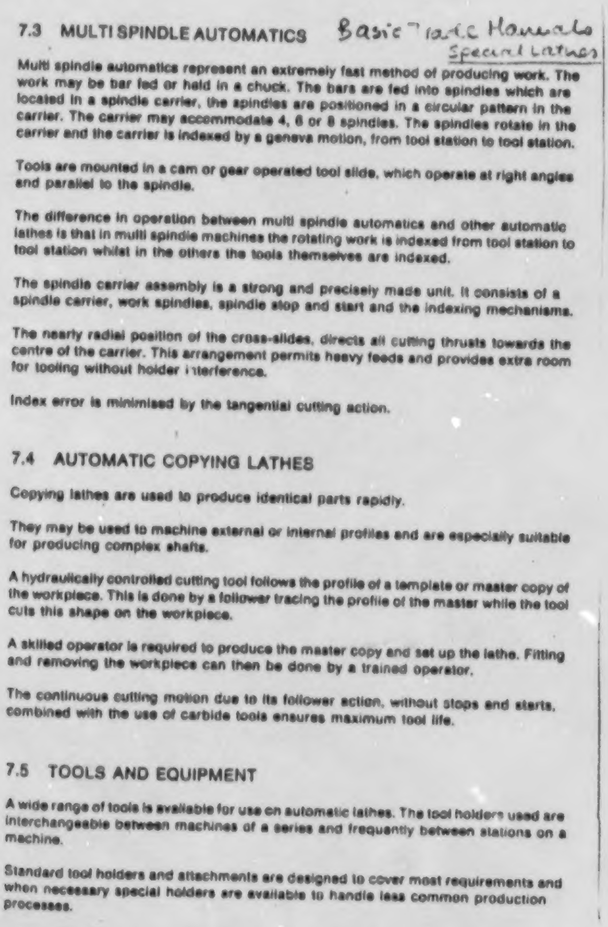
APPENDIX 'A'

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II, (d)	*Basic Trade Manual: Special Lathes*
Purpose	Detailed Job Description
Description	Theory, Procedural Directions
Readability Estimate	10.4

Sample



7.3 MULTI SPINDLE AUTOMATICS

Basic Trade Manuals
Special Lathes

Multi spindle automatics represent an extremely fast method of producing work. The work may be bar fed or held in a chuck. The bars are fed into spindles which are located in a spindle carrier, the spindles are positioned in a circular pattern in the carrier. The carrier may accommodate 4, 6 or 8 spindles. The spindles rotate in the carrier and the carrier is indexed by a geneva motion, from tool station to tool station.

Tools are mounted in a cam or gear operated tool slide, which operate at right angles and parallel to the spindle.

The difference in operation between multi spindle automatics and other automatic lathes is that in multi spindle machines the rotating work is indexed from tool station to tool station whilst in the others the tools themselves are indexed.

The spindle carrier assembly is a strong and precisely made unit. It consists of a spindle carrier, work spindles, spindle stop and start and the indexing mechanisms.

The nearly radial position of the cross-slides, directs all cutting thrusts towards the centre of the carrier. This arrangement permits heavy feeds and provides extra room for tooling without holder interference.

Index error is minimised by the tangential cutting action.

7.4 AUTOMATIC COPYING LATHES

Copying lathes are used to produce identical parts rapidly.

They may be used to machine external or internal profiles and are especially suitable for producing complex shafts.

A hydraulically controlled cutting tool follows the profile of a template or master copy of the workpiece. This is done by a follower tracing the profile of the master while the tool cuts this shape on the workpiece.

A skilled operator is required to produce the master copy and set up the lathe. Fitting and removing the workpiece can then be done by a trained operator.

The continuous cutting motion due to its follower action, without stops and starts, combined with the use of carbide tools ensures maximum tool life.

7.5 TOOLS AND EQUIPMENT

A wide range of tools is available for use on automatic lathes. The tool holders used are interchangeable between machines of a series and frequently between stations on a machine.

Standard tool holders and attachments are designed to cover most requirements and when necessary special holders are available to handle less common production processes.

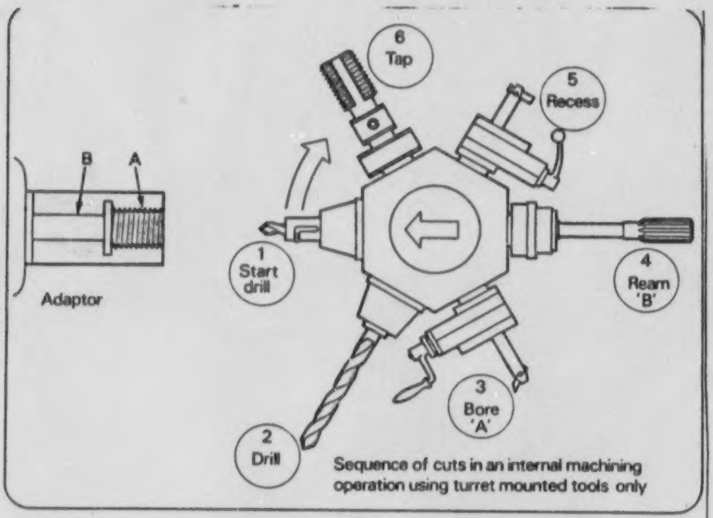
II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II. (d) *Basic Trade Manual: Special Lathes (continued)*

Sample (continued)



Sequence of cuts in an internal machining operation using turret mounted tools only

5.2 DRILLING

Drilling is a method of producing an internal cylindrical cut on a workpiece.

It may be the first cut made in a solid workpiece or it may be an operation to enlarge an existing hole.

Drilling operations performed on lathes are different from vertical drilling work only because on the lathe, the drill remains stationary while the workpiece is rotated. All other practical considerations for vertical drilling may be applied to lathe drilling operations.

The five types of drilling operations performed on turret lathes are:

- Start drilling
- Twist drilling
- Core drilling
- Spade drilling
- Centre drilling.

The appropriate tool is normally mounted on the hexagonal turret in each case.

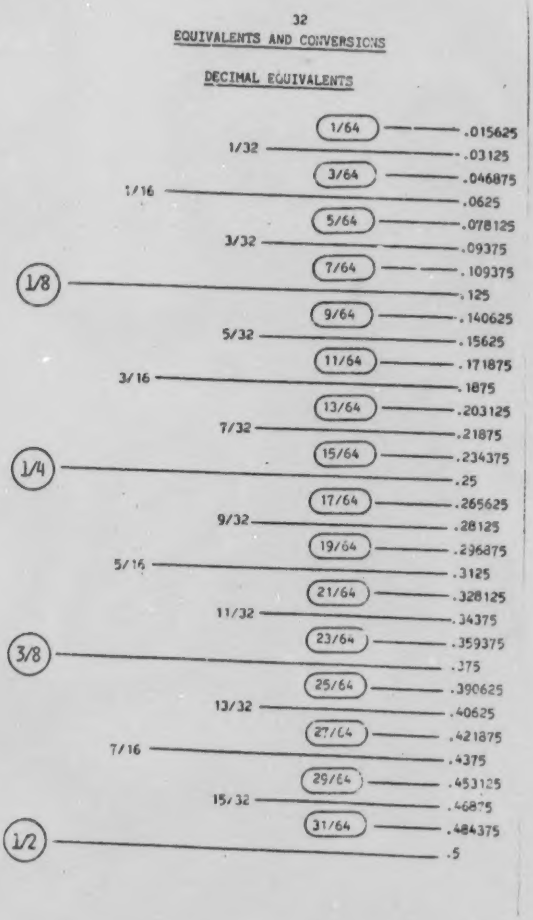
II. FITTING AND MACHINING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document II. (e)	Metric Conversion Chart
Purpose	Metric Conversion
Description	Standards and specifications
Readability	N/a

Sample



32

EQUIVALENTS AND CONVERSIONS

DECIMAL EQUIVALENTS

1/64	.015625
1/32	.03125
3/64	.046875
1/16	.0625
5/64	.078125
3/32	.09375
7/64	.109375
1/8	.125
9/64	.140625
5/32	.15625
11/64	.171875
3/16	.1875
13/64	.203125
7/32	.21875
15/64	.234375
1/4	.25
17/64	.265625
9/32	.28125
19/64	.296875
5/16	.3125
21/64	.328125
11/32	.34375
23/64	.359375
3/8	.375
25/64	.390625
13/32	.40625
27/64	.421875
7/16	.4375
29/64	.453125
15/32	.46875
31/64	.484375
1/2	.5

APPENDIX 'A'

II. FITTING AND MACHINING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document II.(f)	Queensland Department of Technical and Further Education (T.A.F.E.) *Fitting and Machining Notes*
Purpose	College Notes
Description	Theory/Standards Specifications functional description
Readability Estimate	10.9

7.1 In order to obtain precise measurement of a singular component diametrically and longditudinally, in a workshop condition we would use e.g. slip gauges, micrometer vernier calipers.

If precise measurement was required in order to maintain high quality interchangeability in the mass production situation, the above mentioned tools would be inadequate due to wear or variations in the operators "FEEL"

This demand has called for a range of instruments that can be set to check the sizes, withstand wear, and give a constant "FEEL". These instruments are called comparators.

7.2 COMPARATORS

The instrument called a comparator does not incorporate any basic length standard such as slip gauges, micrometer etc. but merely compares a given length with some dimensions to which it has been set.

7.3 COMPARATOR DESIGN

Comparators may operate either on a horizontal or vertical principle, and designs of these are fairly well standardised.

The vertical pattern is most common and consists essentially of a rigid base with a vertical column to carry the measuring instrument. Set in the base and directly below the measuring unit is a table finished to an optically flat surface and sometimes ribbed to reduce friction and the bearing area. Ribbed surfaces provide spaces for particles of grit and dirt.

7.4 DESIRED FEATURES OF A COMPARATOR

A good comparator should be able to record variations of 0.001 mm and should possess the following:

(i) maximum rigidity
(ii) maximum compensation for temperature effects
(iii) neither lag or back lash in the movement of the plunger or recording mechanism

APPENDIX 'A'

II. FITTING AND MACHINING

LITERACY AT COLLEGE

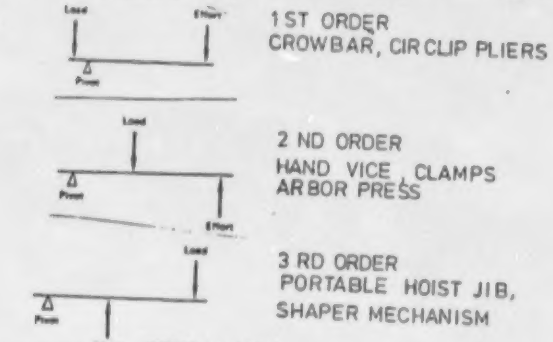
LIST OF READING MATERIALS

Document II. (f)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Fitting and Machining Notes (continued)

Sample (continued)

22:11 The three basic types of levers together with some applications are shown in Fig. 3



ORDERS OF LEVERS
Fig. 3

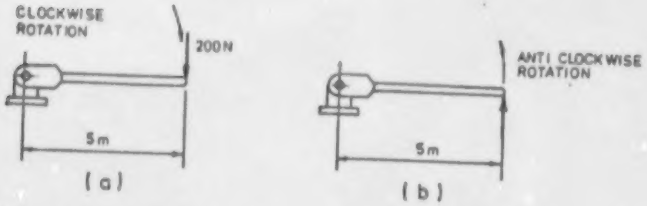
22:12 We have discovered that for a component to be in equilibrium, opposing forces must be equal. Referring to Fig. 3, if we wish the levers to remain stationary (in a state of balance), the load and effort must be acting on it in opposite directions.

22:13 FORMULA = PRINCIPLE OF MOMENTS

For a State of Equilibrium (balance) to exist .

THE TOTAL CLOCKWISE MOMENTS = THE TOTAL ANTICLOCKWISE MOMENTS.

This is called the PRINCIPLE OF MOMENTS.



Clockwise Moments = Force x Dist
= 200 x 5
= 1000 Newton metres

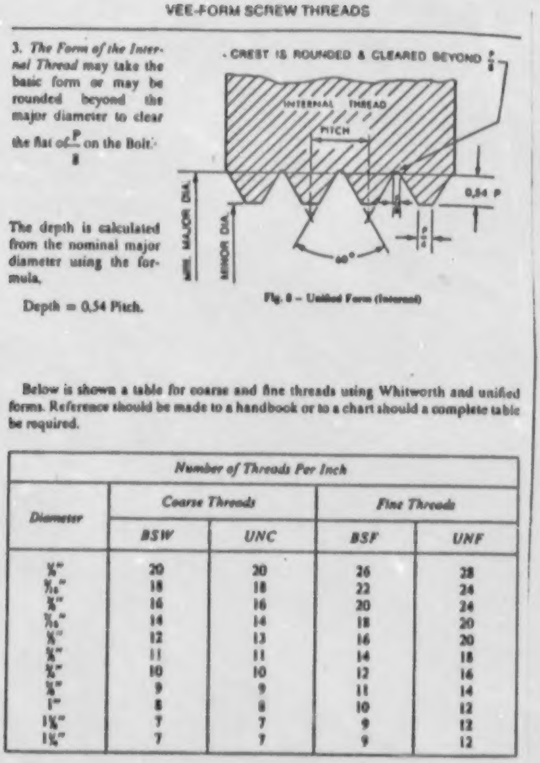
Anticlockwise Moments = Force x Dist
= 200 x 5
= 1000 Newton metres

II. FITTING AND MACHINING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document II. (g)	Education Department of Victoria, Technical Schools Division (1979) *Fitting and Machining 1, 2, 3.*
Purpose	College text
Description	Theory identification, physical description, functional description, procedural directions.
Readability Estimate	10.7
Sample	



VEE-FORM SCREW THREADS

3. *The Form of the Internal Thread* may take the basic form or may be rounded beyond the major diameter to clear the flat of $\frac{P}{8}$ on the Bolt.

The depth is calculated from the nominal major diameter using the formula,

Depth = 0,54 Pitch.

CREST IS ROUNDED & CLEARED BEYOND $\frac{P}{8}$
INTERNAL THREAD
PITCH
0,54 P
MAJOR DIA.
MINOR DIA.
60°

Fig. 8 – Unified Form (Internal)

Below is shown a table for coarse and fine threads using Whitworth and unified forms. Reference should be made to a handbook or to a chart should a complete table be required.

Diameter	*Coarse Threads*		*Fine Threads*	
	BSW	***UNC***	***BSF***	***UNF***
¼"	20	20	26	28
5/16"	18	18	22	24
⅜"	16	16	20	24
7/16"	14	14	18	20
½"	12	13	16	20
⅝"	11	11	14	18
¾"	10	10	12	16
⅞"	9	9	11	14
1"	8	8	10	12
1⅛"	7	7	9	12
1¼"	7	7	9	12

Number of Threads Per Inch

II. FITTING AND MACHINING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document II.(g)

Education Department of Victoria,
Technical Schools Division (1979)
Fitting and Machining 1, 2, 3. (cont.)

Sample (continued)

IV. CUTTING SPEEDS AND FEEDS

The selection of the most suitable cutting speed and feed rate for effective and economical metal removal is an important part of the machinist's work.

A. Cutting Speed

When applied to turning, the cutting speed is defined as the surface or peripheral speed of the work-piece as it passes the cutting tool. It is measured in metres per minute. The desired cutting speed is obtained by proper selection of the revolutions per minute of the lathe spindle.

1. *Cutting Speed and Tool Life.*

The selection of correct cutting speed is important as a small increase in the cutting speed above that which is recommended can greatly reduce the life of the tool while a similar decrease in cutting speed considerably prolongs the tool life.

The estimated tool life for high speed steel turning tools is 60 minutes for general lathe work, and about 240 minutes for intricate tooling set-ups in production machines.

The graph, Fig. 47 shows a typical "Tool Life Cutting Speed" curve for general turning, based on a 60 minute tool life. Note the sharp decline of tool life as the cutting speed increases. It is therefore important to select the correct cutting speed for the diameter required.

Fig. 47 shows a graph based on 60 minute tool life when cutting mild steel at 36 metres per minute (120 feet per minute), depth of cut 5 mm ($\frac{3}{16}$"), feed rate 0,4 mm (0.015") per revolution.

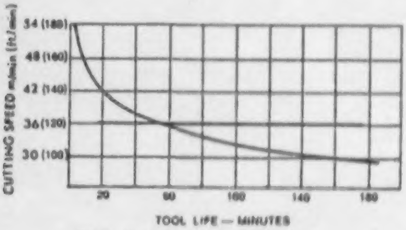


Fig. 47 – Typical Tool Life Cutting Speed Graph

TABLE 1 — POWER FOR MILLING OPERATIONS

MAXIMUM RATE OF METAL REMOVAL—CM³/MIN										
WORK MATERIAL AND APPROXIMATE MAXIMUM BRINELL HARDNESS										
kW Rating	Aluminium	Brass 110	Bronze 130	Steel Mild 150	Steel Medium 180	Steel Tough 200	Steel Alloy 250	Cast Iron 150	Cast Iron 200	Cast Iron 250
2	62	55	37	22	18	13	11	35	29	18
3	97	83	59	33	26	22	18	55	44	29
5	178	154	110	59	48	40	33	101	81	53
7,5	277	242	171	94	77	64	51	158	127	81
10	382	330	233	130	103	86	70	218	174	112
15	584	505	356	198	158	132	105	330	264	171

PRACTICAL NOTE: Another table displaying similar information appears on page 323. A close examination of the entries in each table will indicate slightly different values. This is because various experimental tests provide results having proportionately small differences.

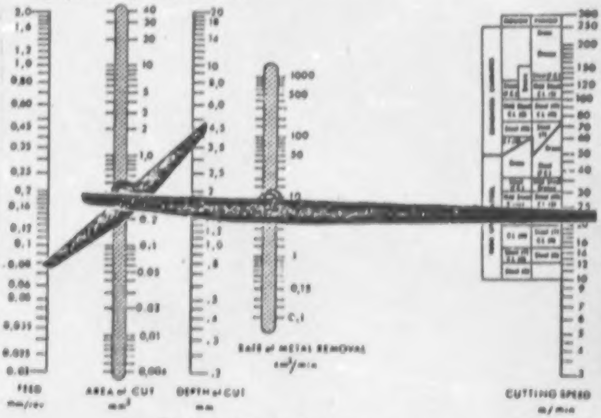


Fig. 6—Cutting Capacity Nomogram

II. FITTING AND MACHINING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document II.(g)

Education Department of Victoria,
Technical Schools Division (1979)
Fitting and Machining 1, 2, 3. (cont.)

Sample (continued)

is particularly important in braking systems where the heat generated at the face of the braking material and its mating surface, together with some abrasion, results in small solid particles breaking off.

(d) *Running-in Ability*
The friction surfaces should "bed in" fairly rapidly. During the initial running-in period localised heat at the small high points of real contact between surfaces reaches such proportions as to cause plastic flow and even partial melting. The softened areas will be smeared so that peaks are removed and valleys filled. The surface then becomes smooth and shiny.

(e) *Absence of Seizure*
Friction materials should not weld or seize with mating surfaces.

(f) *Wear Resistance*
Wear of friction material must not exceed a given value.

(g) *Mechanical Strength*
Friction materials should have good resistance to thermal shock.

(h) *Non-inflammability*
Friction materials should be non-inflammable.

Types of Friction Materials

(a) *Grey Cast-iron*
Grey cast-iron is reasonably satisfactory at low speeds. Formerly it was used for railway brake shoes, but has now been replaced by ceramic bonded shoes. The disadvantage of cast-iron as a friction material for brakes is that the coefficient of friction rapidly decreases with rise in temperature.

It reaches a very low value at 600 °C. This is caused by:

(i) a thin surface layer becoming soft with temperature rise.

(ii) the oxide film formed on the rubbing surface which reduces molecular interaction.

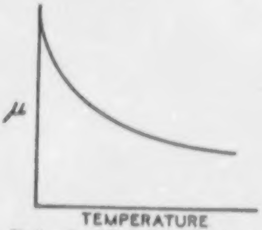


Fig. 3 — Curve Showing How Coefficient of Friction of Grey Cast-iron Decreases with Rise in Temperature

(b) *Organic Friction Materials*

(i) Asbestos-rubber Compositions
These are satisfactory only at operating temperatures less than 300 °C.

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1966, 197

F. Holding the Cutter

The method of holding the cutter is an important detail of cutter sharpening practice.

In general it is desirable to simulate the holding condition when the cutter is in service on the milling machine; for instance, a taper shank end mill is held in a taper shank adaptor; keyway cutters and slitting saws are held between the faces of spacing collars set on a parallel arbor; slab mills are also held in this way but they gain added alignment because of their greater width.

These simulated holding methods are illustrated in Figs. 32, 33, and 34.

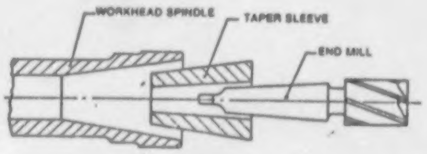


Fig. 32—Holding an End Mill

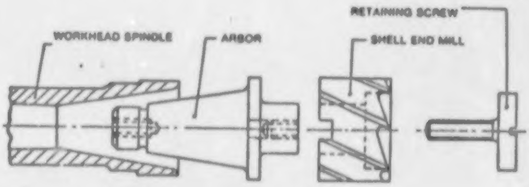


Fig. 33—Holding a Shell End Mill

APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document III. (a)	*Cummins Service - Parts Publication* Cummins, England.
Document III. (b)	*International Harvester Service Bulletin,*
Document III. (c)	*Mazda RX 4 Workshop Manual Chassis.* *Mazda 31600 1975 Workshop Manual.*
Document III. (d)	Volvo 142, 144, 145 *Owner Workshop Manual 1966-73.*
Document III. (e)	*Holden H.Q. Service Manual.*

LITERACY AT COLLEGE

Document III. (f)	May, E., and Crouse, W. (1980) *Automotive Mechanics 1 and 2.* SYDNEY: McGraw Hill.
Document III. (g)	Queensland Department of Technical and Further Education (T.A.F.E.) *Motor Mechanics Notes.*
Document III. (h)	Queensland Department of Technical and Further Education (T.A.F.E.) *Mount Gravatt College Project Sheet.*

APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY ON THE JOB

Document III. (a)	*Cummins Service - Parts Publication,* Cummins, England.
Purpose	Updating Information, Detailed Job Information.
Description	Standards and Specifications
Readability Estimate	13.5

Sample

Service/Parts Topics

July, 1980

No. 80T 1-25

File Group: 1

Ref.: (B) Parts Catalog
Bulletin No. 3379389-00

New Engine Release
(NTC-475 Engine Model)

The purpose of this topic is to release the NTC-475 (CPL-0330) engine model. The NTC-475 engine, Fig. 1, is an MVT equipped Big Cam II, two stage turbocharged engine. Reference Service/Parts Topics 80T 4-2 and 80T 7-9 for more detailed information on the MVT and the Demand Flow Cooling Big Cam II engines, respectively. The subjects discussed in this topic are grouped into the following categories:

I. Two Stage Turbocharging
II. Cooling System
III. Unique Parts List
IV. Engine Specifications
V. Turbocharger Installation Procedures

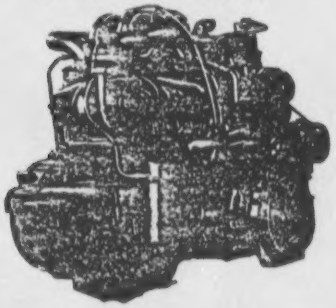


Fig. 1 NTC-475 Engine

I. Two Stage Turbocharging

The NTC-475 engine is equipped with two turbochargers mounted in series to further increase the engine power to weight ratio.

Air flow in this system is from the air cleaner through the first stage, (low pressure turbocharger), then through the second stage, (high pressure turbocharger), before entering the aftercooler housing to cool the air prior to entering the combustion chambers. Reference Fig. 2.

Exhaust flow from the combustion chambers passes through the "pulse-type" exhaust manifolds and provides the energy to drive the turbochargers.

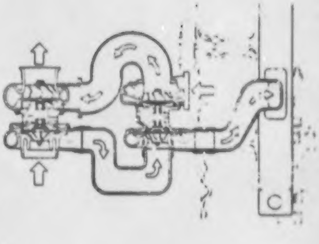


Fig. 2 Turbocharger air flow

II. Cooling System

The following cooling system features are unique to the NTC-475 engine.

- New high fin density aftercooler core, Part No. 3020941.
- 25 g.p.m. flow from the aftercooler water outlet.
- New high flow rate water pump impeller.

III. NTC-475 Unique Parts List

Part No.	Part Name
3011869	Tube, Turbocharger Oil Drain
3011870	Tube, Turbocharger Oil Drain
3020943	Gasket, Exhaust Manifold
3017743	Manifold, Exhaust (Front)
3018100	Manifold, Exhaust (Rear)
3011866	Manifold, Exhaust (Center)
3011875	Capscrew, Manifold Mounting
3011876	Gasket, Turbocharger (Low Pressure Turbocharger)
3011868	Brace, Exhaust Outlet Connection (Low Pressure Turbocharger)

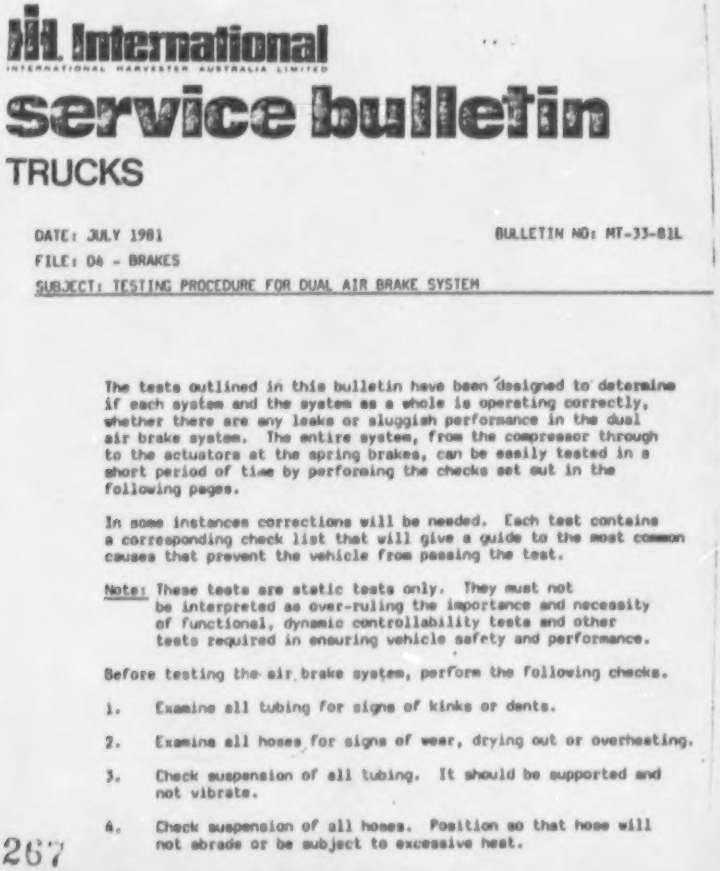
III. MOTOR MECHANICS

APPENDIX 'A'

LITERACY ON THE JOB

Document III. (b)	*International Harvester Service Bulletin*
Purpose	Detailed Job Instruction Updating Information
Description	Standards and Specifications Procedural Directions Procedural checkpoints
Readability Estimate	12.7

Sample



IH International

INTERNATIONAL HARVESTER AUSTRALIA LIMITED

service bulletin

TRUCKS

DATE: JULY 1981

BULLETIN NO: MT-33-81L

FILE: 04 - BRAKES

SUBJECT: TESTING PROCEDURE FOR DUAL AIR BRAKE SYSTEM

The tests outlined in this bulletin have been designed to determine if each system and the system as a whole is operating correctly, whether there are any leaks or sluggish performance in the dual air brake system. The entire system, from the compressor through to the actuators at the spring brakes, can be easily tested in a short period of time by performing the checks set out in the following pages.

In some instances corrections will be needed. Each test contains a corresponding check list that will give a guide to the most common causes that prevent the vehicle from passing the test.

Note: These tests are static tests only. They must not be interpreted as over-ruling the importance and necessity of functional, dynamic controllability tests and other tests required in ensuring vehicle safety and performance.

Before testing the air brake system, perform the following checks.

1. Examine all tubing for signs of kinks or dents.
2. Examine all hoses for signs of wear, drying out or overheating.
3. Check suspension of all tubing. It should be supported and not vibrate.
4. Check suspension of all hoses. Position so that hose will not abrade or be subject to excessive heat.

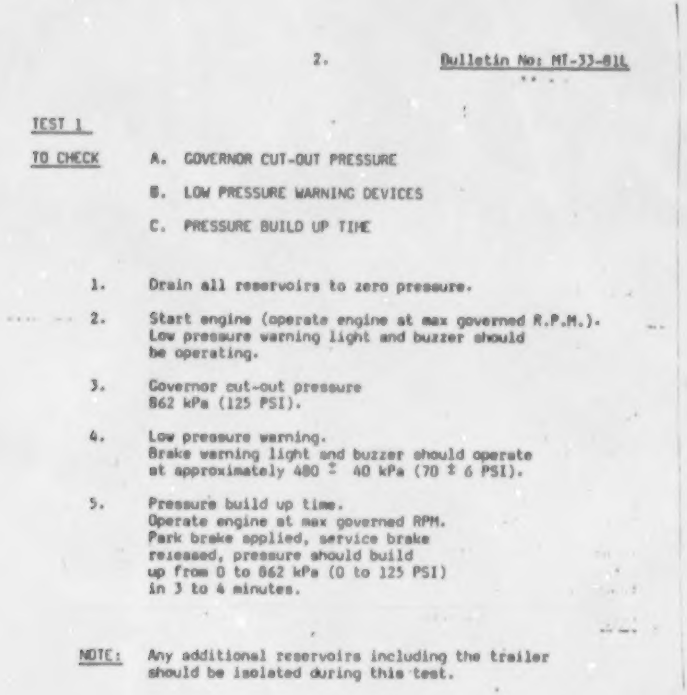
III. MOTOR MECHANICS

APPENDIX 'A'

LITERACY ON THE JOB

Document III. (b) *International Harvester Service Bulletin* (continued)

Sample (continued)



2. **Bulletin No: MT-33-81L**

TEST 1

TO CHECK
A. GOVERNOR CUT-OUT PRESSURE
B. LOW PRESSURE WARNING DEVICES
C. PRESSURE BUILD UP TIME

1. Drain all reservoirs to zero pressure.
2. Start engine (operate engine at max governed R.P.M.). Low pressure warning light and buzzer should be operating.
3. Governor cut-out pressure 862 kPa (125 PSI).
4. Low pressure warning. Brake warning light and buzzer should operate at approximately 480 ± 40 kPa (70 ± 6 PSI).
5. Pressure build up time. Operate engine at max governed RPM. Park brake applied, service brake released, pressure should build up from 0 to 862 kPa (0 to 125 PSI) in 3 to 4 minutes.

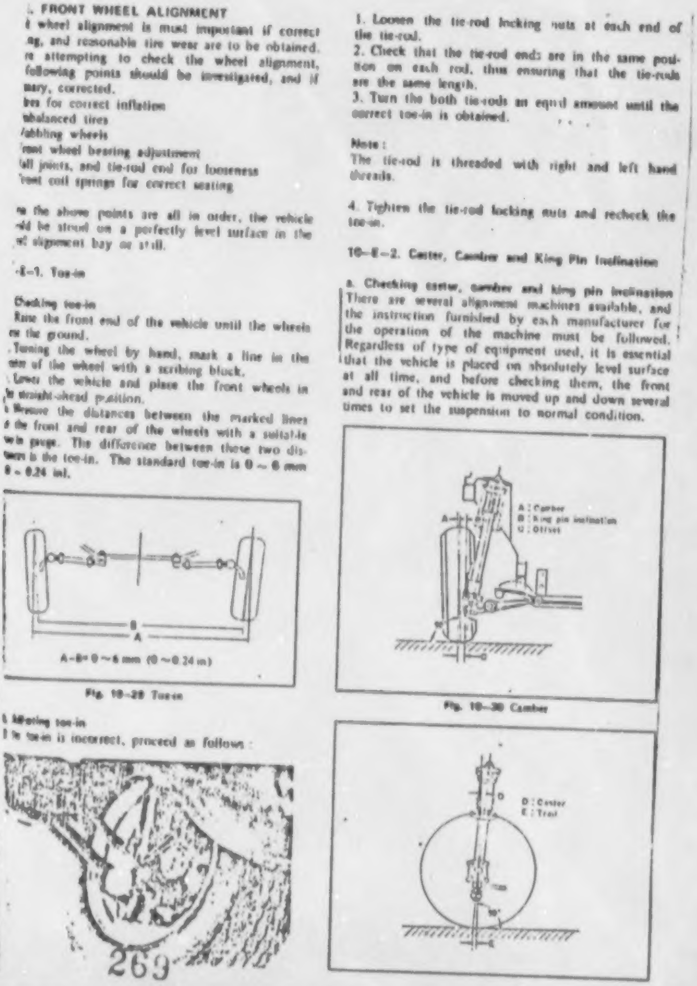
NOTE: Any additional reservoirs including the trailer should be isolated during this test.

III. MOTOR MECHANICS APPENDIX 'A'

LITERACY ON THE JOB

Document III (c)	Mazda Workshop Manuals.
Purpose	Detailed job instructions
Description	Standards and Specifications Procedural Directions
Readability Estimate	11.5

Sample



. FRONT WHEEL ALIGNMENT

t wheel alignment is most important if correct ng, and reasonable tire wear are to be obtained. re attempting to check the wheel alignment, following points should be investigated, and if sary, corrected.

res for correct inflation
nbalanced tires
Vobbling wheels
ront wheel bearing adjustment
all joints, and tie-rod end for looseness
ront coil springs for correct seating

e the above points are all in order, the vehicle ld be stood on a perfectly level surface in the el alignment bay or still.

-E-1. Toe-in

Checking toe-in

Raise the front end of the vehicle until the wheels re the ground.

. Turning the wheel by hand, mark a line in the tre of the wheel with a scribing block.

. Lower the vehicle and place the front wheels in he straight-ahead position.

. Measure the distances between the marked lines t the front and rear of the wheels with a suitable toe-in gauge. The difference between these two distances is the toe-in. The standard toe-in is 0 ~ 6 mm 0 ~ 0.24 in).

Fig. 10-29 Toe-in

b. Adjusting toe-in

If the toe-in is incorrect, proceed as follows:

1. Loosen the tie-rod locking nuts at each end of the tie-rod.
2. Check that the tie-rod ends are in the same position on each rod, thus ensuring that the tie-rods are the same length.
3. Turn the both tie-rods an equal amount until the correct toe-in is obtained.

Note:

The tie-rod is threaded with right and left hand threads.

4. Tighten the tie-rod locking nuts and recheck the toe-in.

10-E-2. Caster, Camber and King Pin Inclination

a. Checking caster, camber and king pin inclination

There are several alignment machines available, and the instruction furnished by each manufacturer for the operation of the machine must be followed. Regardless of type of equipment used, it is essential that the vehicle is placed on absolutely level surface at all time, and before checking them, the front and rear of the vehicle is moved up and down several times to set the suspension to normal condition.

Fig. 10-30 Camber

III. MOTOR MECHANICS

LITERACY ON THE JOB

Document III (c) Mazda Workshop Manuals (continued)

Sample (continued)

5-D. ALTERNATOR

5-D-1. Precautions on Service

When servicing the charging system, observe the following precautions. If not followed, the result will be in serious damage of the system.

1. Do not short across or ground any of the terminals on the alternator.
2. Never operate the alternator on an open circuit (with the field terminal connected and the armature terminal disconnected).
3. When installing the battery, always make sure that the negative post of the battery is attached securely to the ground strap.
4. Never reverse battery leads, even for an instant, as the reverse polarity current flow will damage the diodes in the alternator.
5. When charging the battery with a fast charger, disconnect the positive cable at the battery.

5-D-2. Checking Charging System on Car

If the electrical system is not charging properly, it is advisable to determine whether the trouble is in the alternator or regulator prior to removing the alternator.

1. Disconnect the wire from "B" terminal of the alternator and connect the ammeter with the negative lead of the ammeter to the wire and the positive lead to the "B" terminal, as shown in Fig. 5-11.
2. Disconnect the coupler from the regulator. Connect the disconnected couplers with the suitable wires.
3. Start the engine and take a reading of the ammeter, holding the engine speed to 2,000 rpm.
4. Disconnect the wire from the F terminal and short-circuit the wire to the A terminal for a moment.
5. If the meter reading increases remarkably, the trouble is in the regulator and if there is no change in current, it is in the alternator.

5-D-3. Disassembling Alternator

1. Remove the radio noise suppression
the rear of the alternator.
2. Remove the nut and washer attac
to the shaft. Remove the pulley, fan
3. Remove the through bolts.
4. Separate the front housing assembly
with a screwdriver at the slots of the
5. Remove the rotor from the front h
6. Remove the nut, washers and insul
B terminal at the rear of the alternato
7. Remove the three screws attaching
to the rear housing.
8. Unscrew but do not remove the tw
attaching screws. The screws will help
terminals in the brush holder during r
stator and attached parts.
9. Carefully remove the stator, heat si
holder assembly from the rear housing.
keep the brush holder assembly intact d
from the rear housing.
10. Unsolder the stator leads from the
brush holder assembly.
11. If brush holder assembly replacement
unsolder the brush holder wire from the p
12. If bearing replacement is necessary,
rear bearing from the rotor shaft with a
To replace the front bearing, remove the
tainer attaching screws, and press the b
the front housing.

5-D-4. Alternator Inspection

a. Checking stator coil

Check the stator coil for both open an
circuits with an ohmmeter.
To check for open, connect the prods
the two leads, as shown in Fig. 5-12.

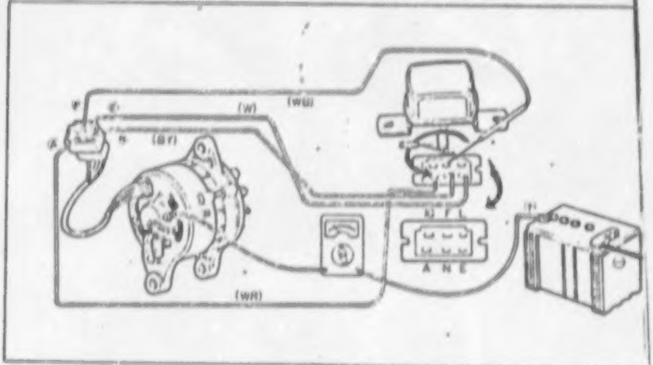


Fig. 5-11 Checking charging system

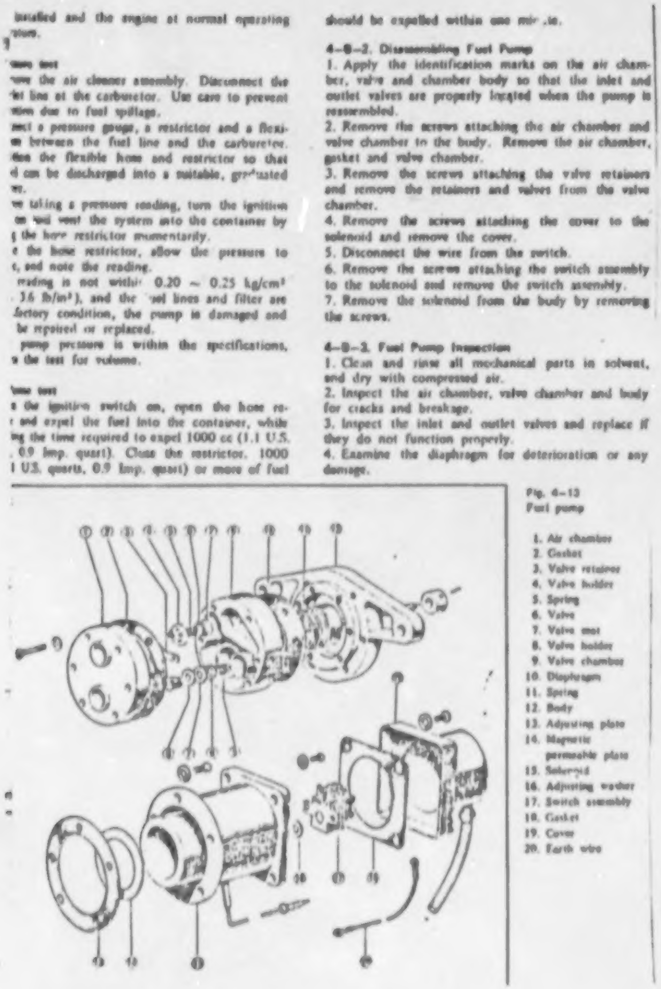
APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY ON THE JOB

Document III (c) Mazda Workshop Manuals (continued)

Sample (continued)



installed and the engine at normal operating
tion.

ure test
ove the air cleaner assembly. Disconnect the
let line at the carburetor. Use care to prevent
tion due to fuel spillage.
ect a pressure gauge, a restrictor and a flexi-
e between the fuel line and the carburetor.
tion the flexible hose and restrictor so that
d can be discharged into a suitable, graduated
er.
re taking a pressure reading, turn the ignition
on and vent the system into the container by
g the hose restrictor momentarily.
e the hose restrictor, allow the pressure to
, and note the reading.
reading is not within 0.20 ~ 0.25 kg/cm²
3.6 lb/in²), and the fuel lines and filter are
factory condition, the pump is damaged and
be repaired or replaced.
pump pressure is within the specifications,
the test for volume.

ume test
the ignition switch on, open the hose re-
and expel the fuel into the container, while
ng the time required to expel 1000 cc (1.1 U.S.
, 0.9 Imp. quart). Close the restrictor. 1000
1 U.S. quarts, 0.9 Imp. quart) or more of fuel
should be expelled within one minute.

4-8-2. Disassembling Fuel Pump

1. Apply the identification marks on the air chamber, valve and chamber body so that the inlet and outlet valves are properly located when the pump is reassembled.
2. Remove the screws attaching the air chamber and valve chamber to the body. Remove the air chamber, gasket and valve chamber.
3. Remove the screws attaching the valve retainers and remove the retainers and valves from the valve chamber.
4. Remove the screws attaching the cover to the solenoid and remove the cover.
5. Disconnect the wire from the switch.
6. Remove the screws attaching the switch assembly to the solenoid and remove the switch assembly.
7. Remove the solenoid from the body by removing the screws.

4-8-3. Fuel Pump Inspection

1. Clean and rinse all mechanical parts in solvent, and dry with compressed air.
2. Inspect the air chamber, valve chamber and body for cracks and breakage.
3. Inspect the inlet and outlet valves and replace if they do not function properly.
4. Examine the diaphragm for deterioration or any damage.

Fig. 4-13
Fuel pump

1. Air chamber
2. Gasket
3. Valve retainer
4. Valve holder
5. Spring
6. Valve
7. Valve seat
8. Valve holder
9. Valve chamber
10. Diaphragm
11. Spring
12. Body
13. Adjusting plate
14. Magnetic permeable plate
15. Solenoid
16. Adjusting washer
17. Switch assembly
18. Gasket
19. Cover
20. Earth wire

Comment

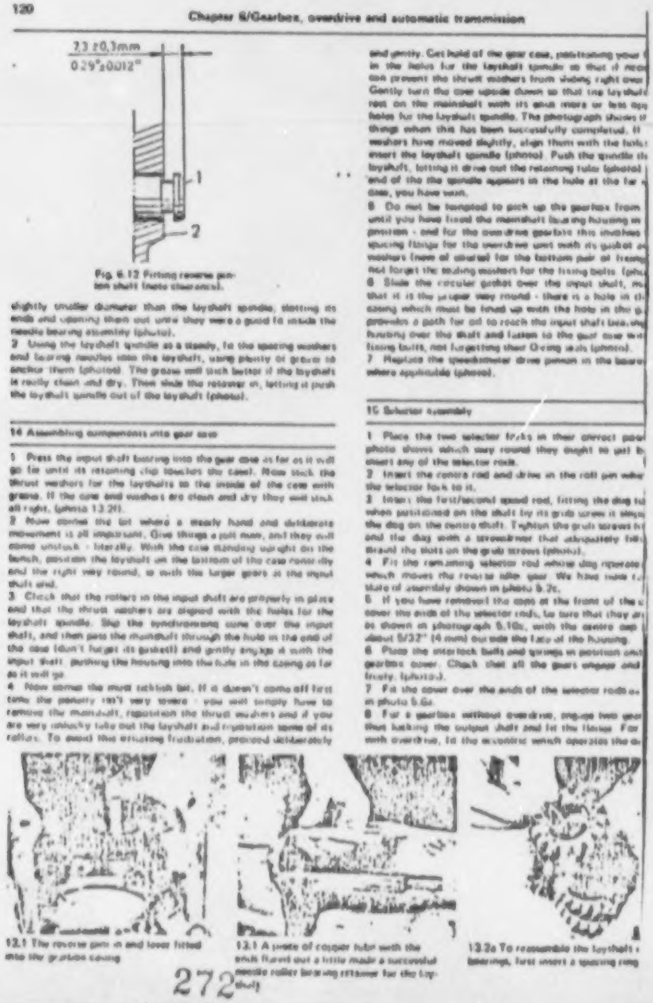
Note Graphics.
Syntax and vocabulary is occasionally unusual. For example, "if the meter reading increases remarkably it is in the regulator and if there is no change in the current, it is in the alternator". Perhaps this is the "Japanese" English one mechanic reported having difficulty with.

III. MOTOR MECHANICS

LITERACY ON THE JOB

Document III.(d)	Volvo 142, 144, 145 *Owner Workshop Manual*
Purpose	Detailed job description
Description	Standards and Specifications Procedural Directions
Readability Estimate	9.6

Sample



III. MOTOR MECHANICS

LITERACY ON THE JOB

Document III (d)	Volvo 142, 144, 145 *Owner Workshop Manual (continued)*
Comment	Note informal language register. For example, "Now comes the ticklish bit...".

APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY ON THE JOB

Document III (e)	*Holden H.Q. Service Manual*
Purpose	Detailed Job Instructions
Description	Procedural Directions
Readability Estimate	12

Sample

253 AND 308 ENGINE ASSEMBLY 20

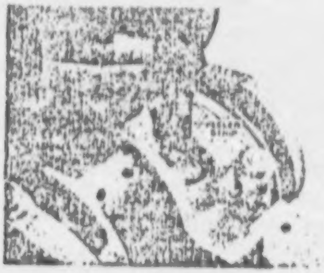


Fig. 32
Measuring Crankshaft End Play

2. Install flywheel or converter drive plate to crankshaft and tighten attaching bolts to specification listed at the rear of this section.
3. Lubricate the camshaft bearings with engine oil and install the camshaft assembly being careful not to damage the bearings.
4. Install camshaft locator and tighten attaching bolt to specification listed at the rear of this section.
5. Install the sprockets and timing chain so that the timing marks on the sprocket are in line with the timing marks on the chain when the sprockets are fully installed (Fig. 33).
6. Install fuel pump eccentric and camshaft sprocket retaining bolt (Fig. 34). Tighten bolt to specification listed at the rear of this section.
7. Install timing chain damper and adjust damper so that all slack is taken up in chain (Fig. 35).
8. Install connecting rod and piston assemblies as follows:
    - (a) Install connecting rod bearings in connecting rods and connecting rod caps, then lubricate bearings, pistons, piston rings and cylinder walls lightly with engine oil.
    - (b) Install a suitable piece of hose over threads of rod bolts to prevent damage to bearing journal and rod bolt threads. Refer Fig. 29. Using a suitable ring compressor to compress the rings, install number one connecting rod and piston assembly in its respective bore. Use a hammer handle and light blows, hold the ring compressor firmly against the cylinder block until all piston rings have entered the bore.

      CAUTION: *Be sure ring gaps are properly positioned on pistons (Fig. 36). Install pistons with the cast notch toward the front of the engine.*
    - (c) Remove hose from threads of rod bolts then install connecting rod cap and torque nuts to specification listed at the rear of this section. Repeat steps (b) and (c) for the remaining connecting rod and piston assemblies.

Timing Cha

Fuel (

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III (f)	May, E. and Crouse, W. (1980) *Automotive Mechanics 1 and 2.* Sydney: McGraw Hill
Purpose	College text
Description	Theory
Readability Estimate	10.5

Sample

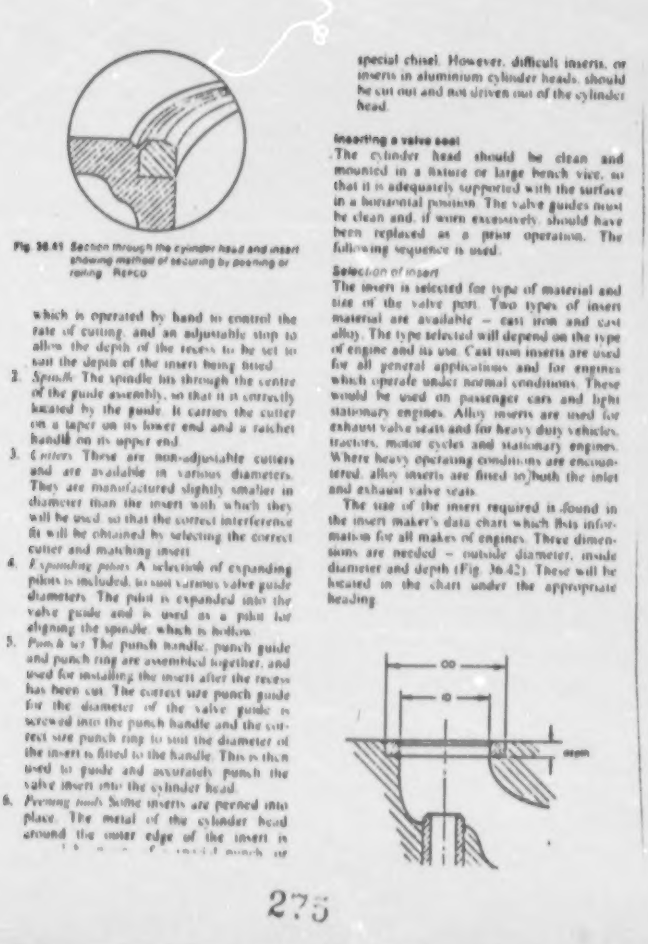


Fig. 36.41 Section through the cylinder head and insert showing method of securing by peening or rolling Repco

which is operated by hand to control the rate of cutting, and an adjustable stop to allow the depth of the recess to be set to suit the depth of the insert being fitted.

2. *Spindle* The spindle fits through the centre of the guide assembly, so that it is correctly located by the guide. It carries the cutter on a taper on its lower end and a ratchet handle on its upper end.
3. *Cutters* These are non-adjustable cutters and are available in various diameters. They are manufactured slightly smaller in diameter than the insert with which they will be used, so that the correct interference fit will be obtained by selecting the correct cutter and matching insert.
4. *Expanding pilots* A selection of expanding pilots is included, to suit various valve guide diameters. The pilot is expanded into the valve guide and is used as a pilot for aligning the spindle, which is hollow.
5. *Punch set* The punch handle, punch guide and punch ring are assembled together, and used for installing the insert after the recess has been cut. The correct size punch guide for the diameter of the valve guide is screwed into the punch handle and the correct size punch ring to suit the diameter of the insert is fitted to the handle. This is then used to guide and accurately punch the valve insert into the cylinder head.
6. *Peening tools* Some inserts are peened into place. The metal of the cylinder head around the outer edge of the insert is [illegible] of a special punch or special chisel. However, difficult inserts, or inserts in aluminium cylinder heads, should be cut out and not driven out of the cylinder head.

Inserting a valve seat

The cylinder head should be clean and mounted in a fixture or large bench vice, so that it is adequately supported with the surface in a horizontal position. The valve guides must be clean and, if worn excessively, should have been replaced as a prior operation. The following sequence is used.

Selection of insert

The insert is selected for type of material and size of the valve port. Two types of insert material are available – cast iron and cast alloy. The type selected will depend on the type of engine and its use. Cast iron inserts are used for all general applications and for engines which operate under normal conditions. These would be used on passenger cars and light stationary engines. Alloy inserts are used for exhaust valve seats and for heavy duty vehicles, tractors, motor cycles and stationary engines. Where heavy operating conditions are encountered, alloy inserts are fitted to both the inlet and exhaust valve seats.

The size of the insert required is found in the insert maker's data chart which lists information for all makes of engines. Three dimensions are needed – outside diameter, inside diameter and depth (Fig. 36.42). These will be located in the chart under the appropriate heading.

APPENDIX 'A'

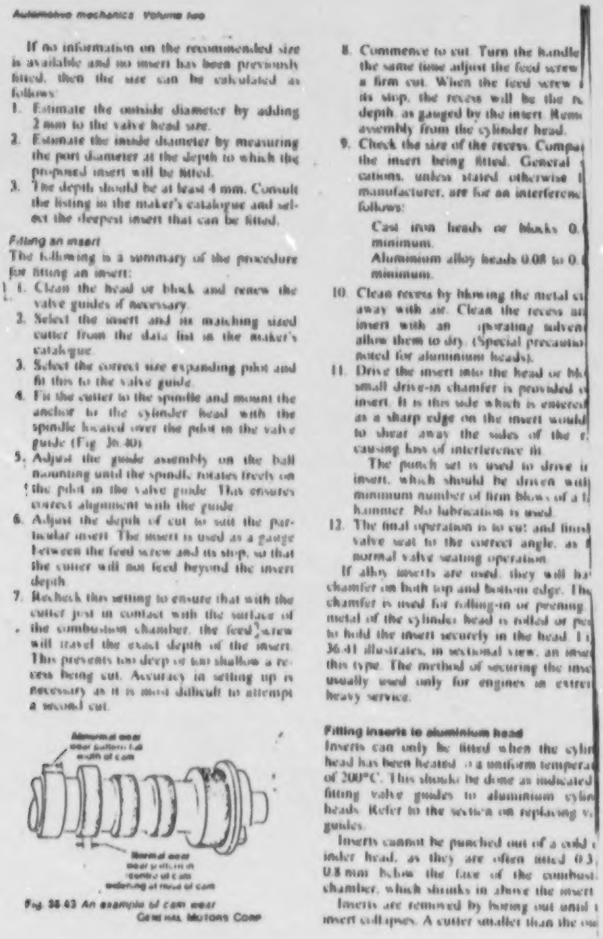
III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III (f)

May, E. and Crouse, W. (1980)
Automotive Mechanics 1 and 2.
Sydney: McGraw Hill (continued)

Sample



Automotive mechanics Volume two

If no information on the recommended size is available and no insert has been previously fitted, then the size can be calculated as follows:

1. Estimate the outside diameter by adding 2 mm to the valve head size.
2. Estimate the inside diameter by measuring the port diameter at the depth to which the proposed insert will be fitted.
3. The depth should be at least 4 mm. Consult the listing in the maker's catalogue and select the deepest insert that can be fitted.

Fitting an insert

The following is a summary of the procedure for fitting an insert:

1. Clean the head or block and renew the valve guides if necessary.
2. Select the insert and its matching sized cutter from the data list in the maker's catalogue.
3. Select the correct size expanding pilot and fit this to the valve guide.
4. Fit the cutter to the spindle and mount the anchor to the cylinder head with the spindle located over the pilot in the valve guide (Fig. 36.40).
5. Adjust the guide assembly on the ball mounting until the spindle rotates freely on the pilot in the valve guide. This ensures correct alignment with the guide.
6. Adjust the depth of cut to suit the particular insert. The insert is used as a gauge between the feed screw and its stop, so that the cutter will not feed beyond the insert depth.
7. Recheck this setting to ensure that with the cutter just in contact with the surface of the combustion chamber, the feed screw will travel the exact depth of the insert. This prevents too deep or too shallow a recess being cut. Accuracy in setting up is necessary as it is most difficult to attempt a second cut.

Abnormal wear
wear pattern full width of cam

Normal wear
wear pattern in centre of cam
widening at nose of cam

Fig. 36.43 An example of cam wear
General Motors Corp

8. Commence to cut. Turn the handle
the same time adjust the feed screw
a firm cut. When the feed screw
its stop, the recess will be the re
depth as gauged by the insert. Remo
assembly from the cylinder head.
9. Check the size of the recess. Compa
the insert being fitted. General
cations, unless stated otherwise
manufacturer, are for an interferenc
follows:

   Cast iron heads or blocks 0.
   minimum.
   Aluminium alloy heads 0.08 to 0.
   minimum.

10. Clean recess by blowing the metal c
away with air. Clean the recess an
insert with an evaporating solven
allow them to dry. (Special precautio
noted for aluminium heads).
11. Drive the insert into the head or bl
small drive-in chamfer is provided
insert. It is this side which is entered
as a sharp edge on the insert would
to shear away the sides of the
causing loss of interference fit.

    The punch set is used to drive
insert, which should be driven wit
minimum number of firm blows of a
hammer. No lubrication is used.
12. The final operation is to cut and finis
valve seat to the correct angle, as
normal valve seating operation.

If alloy inserts are used, they will ha
chamfer on both top and bottom edge. Th
chamfer is used for rolling-in or peening
metal of the cylinder head is rolled or pe
to hold the insert securely in the head. F
36.41 illustrates, in sectional view, an inse
this type. The method of securing the inse
usually used only for engines in extre
heavy service.

Fitting inserts to aluminium head

Inserts can only be fitted when the cyli
head has been heated to a uniform tempera
of 200°C. This should be done as indicated
fitting valve guides to aluminium cyli
heads. Refer to the section on replacing v
guides.

Inserts cannot be punched out of a cold
inder head, as they are often fitted 0.3
0.8 mm below the face of the combust
chamber, which shrinks in above the insert

Inserts are removed by boring out until
insert collapses. A cutter smaller than the ou

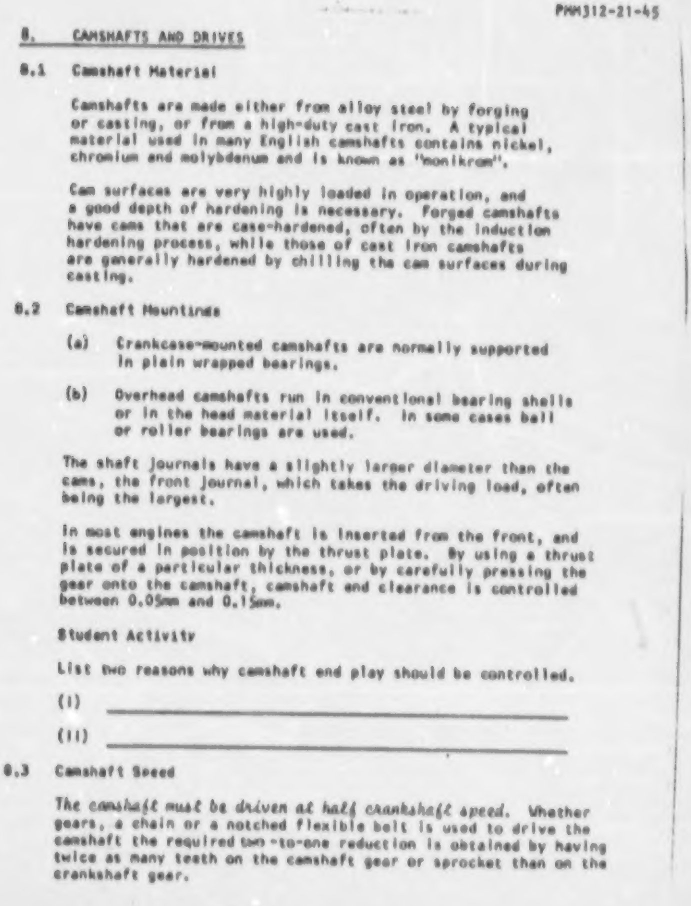
APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III. (g)	Queensland Department of Technical and Further Education (T.A.F.E.) *Motor Mechanics Notes*
Purpose	College Notes
Description	Procedural Directions Theory
Readability Estimate	10.8

Sample



PMM312-21-45

8. CAMSHAFTS AND DRIVES

8.1 Camshaft Material

Camshafts are made either from alloy steel by forging or casting, or from a high-duty cast iron. A typical material used in many English camshafts contains nickel, chromium and molybdenum and is known as "monikrom".

Cam surfaces are very highly loaded in operation, and a good depth of hardening is necessary. Forged camshafts have cams that are case-hardened, often by the induction hardening process, while those of cast iron camshafts are generally hardened by chilling the cam surfaces during casting.

8.2 Camshaft Mountings

(a) Crankcase-mounted camshafts are normally supported in plain wrapped bearings.

(b) Overhead camshafts run in conventional bearing shells or in the head material itself. In some cases ball or roller bearings are used.

The shaft journals have a slightly larger diameter than the cams, the front journal, which takes the driving load, often being the largest.

In most engines the camshaft is inserted from the front, and is secured in position by the thrust plate. By using a thrust plate of a particular thickness, or by carefully pressing the gear onto the camshaft, camshaft and clearance is controlled between 0.05mm and 0.15mm.

Student Activity

List two reasons why camshaft end play should be controlled.

(i) ____________________

(ii) ____________________

8.3 Camshaft Speed

The camshaft must be driven at half crankshaft speed. Whether gears, a chain or a notched flexible belt is used to drive the camshaft the required two-to-one reduction is obtained by having twice as many teeth on the camshaft gear or sprocket than on the crankshaft gear.

APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III. (g)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Motor Mechanics Notes (continued)

Sample (continued)

87

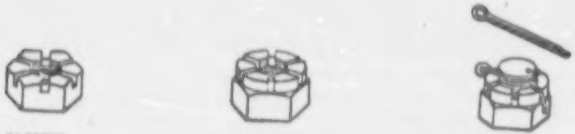
CHAPTER 6 LOCKING DEVICES, LIMITS FITS AND WEAR, WORKSHOP AND SPARE PARTS MANUALS

1. Locking Devices. A bolt and nut holds parts together by a clamping effect and any tendency towards sideward movement between the parts is resisted by friction. The friction existing between surfaces is determined by how tightly the parts are clamped together.

When a nut is tightened on a bolt, the bolt tends to stretch and is said to be "in tension" (like a rubber band). At the same time the thread in the nut distorts and an interlocking effect between the threads occurs. If a bolt is made of high quality alloy steel its elasticity will be maintained and the nut will stay tight. Bolts of this type are called "high tensile" and are used in locations subject to high stress and vibration. Some typical examples are big-end bolts, cylinder head bolts and valve rocker studs.

High tensile screw fasteners are expensive and so lower grace carbon steel types are in more general use. These are satisfactory if tightened correctly but have a tendency to lose tension when subjected to vibration and movement between parts. Once the internal "pull" or tension of a bolt is lost the nut loosens. It is necessary therefore, to rely on various types of locking devices to keep screw fasteners tight where the elasticity of the material is insufficient for this purpose.

1.1 Slotted Nuts. Two kinds of slotted nuts are shown in Fig. 1, regular and castellated. Both are used on bolts or threaded shafts that are drilled for cotter (split) pins. The nut is tightened until slots line up with the pin hole and a cotter pin is inserted through the nut and the bolt.



SLOTTED CASTELLATED SPLIT PIN

Fig. 1

If the cotter pin is a good tight fit and the ends properly spread the nut will not loosen. The head of the pin should be tapped firmly into the slot and the excess length of pin cut off. A cotter pin should not be loose in the slots or hole otherwise movement of the nut could shear off the pin.

Castellated nuts are used mainly for adjustment purposes. For example, the tapered bearings in front wheels are tightened with a castellated nut until they bind slightly. The nut is then backed off one castellation and the pin inserted. The nut is not a tight fit on the axle and only the cotter pin prevents it from moving.

../2

APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III. (g)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Motor Mechanic Notes (continued)

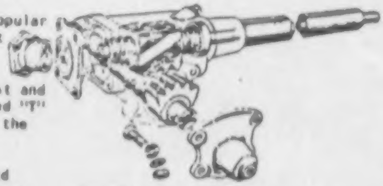
Sample (continued)

2.5 Recirculating-ball boxes (Fig. 4)

These are probably the most popular adaptation of the worm and nut principle.

The sector shaft is made robust and has tapered teeth. The slotted "T" end of the shaft accommodates the "captive" adjustment screw.

A "block" type ball nut is used and this has several teeth on one side with which the sector shaft meshes.



—Ball-recirculating Gear with Nut Employing Two Independent Ball Circuits

FIG.4

The inside of the nut is bored out slightly larger than the overall diameter of the worm, and has helical grooves to correspond with the grooves of the worm. The nut itself does not mesh with the worm. This circular "tunnel" formed between the grooves in the nut and the worm, is filled with steel balls and forms a "thread" between the two parts. When the steering shaft is turned the nut travels along the worm, just as a nut would travel on an ordinary screw-thread.

A separate ball "circuit" is provided at each end of the nut, and used tubular return guides clamped to the top of the nut. The balls can travel once around the worm shaft, but then they are collected on one side of the nut, passed through the tubular guides diagonally across the back of the nut, and returned into the nut on the opposite side.

The sectioned view in Fig. 5 illustrates the two separate ball circuits. It also shows how the guide tubes collect the balls to pass them across the back of the nut. These "closed circuits" keep the ball within the nut - hence the name recirculating.

When the steering wheel is turned the nut travels along the worm, and because the nut is meshed with the sector gear the sector shaft is rotated. The rolling action of the balls provide very light and almost frictionless movement.

The captive adjustment screw must not have end play in its slot in the sector shaft, and is used to control the back-lash between the sector gear and the nut.

This design of box gives long service with little wear, and an example of its popularity is its use on Valiant, Holden and Falcon Vehicles.

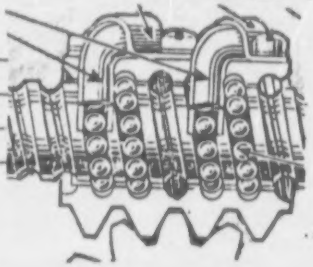


FIG.5

../7

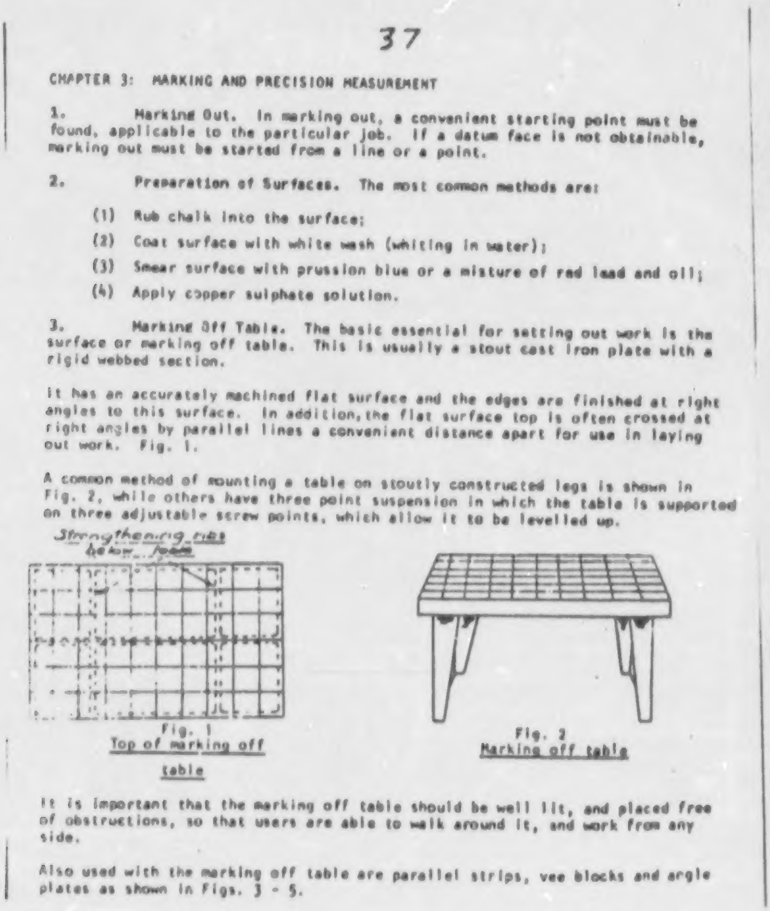
III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III. (g)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Motor Mechanics Notes (continued)

Sample (continued)



37

CHAPTER 3: MARKING AND PRECISION MEASUREMENT

1. Marking Out. In marking out, a convenient starting point must be found, applicable to the particular job. If a datum face is not obtainable, marking out must be started from a line or a point.

2. Preparation of Surfaces. The most common methods are:

(1) Rub chalk into the surface;
(2) Coat surface with white wash (whiting in water);
(3) Smear surface with prussion blue or a misture of red lead and oil;
(4) Apply copper sulphate solution.

3. Marking Off Table. The basic essential for setting out work is the surface or marking off table. This is usually a stout cast iron plate with a rigid webbed section.

It has an accurately machined flat surface and the edges are finished at right angles to this surface. In addition, the flat surface top is often crossed at right angles by parallel lines a convenient distance apart for use in laying out work. Fig. 1.

A common method of mounting a table on stoutly constructed legs is shown in Fig. 2, while others have three point suspension in which the table is supported on three adjustable screw points, which allow it to be levelled up.

Fig. 1
Top of marking off
table

Fig. 2
Marking off table

It is important that the marking off table should be well lit, and placed free of obstructions, so that users are able to walk around it, and work from any side.

Also used with the marking off table are parallel strips, vee blocks and angle plates as shown in Figs. 3 - 5.

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III. (g)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Motor Mechanics Notes (continued)

Sample (continued)

PMM211-13-11

4. CAM FOLLOWERS.

4.1 Hydraulic Valve Lifters.

These are self-adjusting cam followers which maintain zero tappet clearance without interfering with the proper closing of the engine valves. They reduce noise and maintain the ideal valve timing by compensating for the variation in dimensions of parts caused by changes in engine temperature, and for minor wear occurring at various locations. The valve and seat hammering and wear that can develop with excessive tappet clearances is therefore reduced to a minimum.

Construction. Refer to Figure 21. Hydraulic lifters are similar in outward appearance and size to ordinary mechanical lifters. Note. Plungers and lifter bodies should not be intermixed during servicing; they are assembled with a selective fit to give the required "leak-down" rate. It is also desirable to fit each lifter assembly back into the engine block bore from which it was removed, in order to retain the "mated" wearing surfaces.

Leak-Down. This is the specified rate of oil leakage from the lifter body past its plunger. Leak-down allows air to bleed out of the cavity between the plunger and lifter body. It also enables the tappet clearance to be automatically adjusted to zero each time an engine valve closes, thus eliminating the possibility of negative lash which would hold a valve partly open. However, excessive leak-down will reduce the valve "lift".

Operation. At the start of the cycle the spring forces the plunger and lifter body apart. This keeps the lifter body in contact with the cam and absorbs all lash in the valve linkage. Whenever the lifter body is on the heel of the cam, pressurised oil from the engine system passes through openings into the lifter body. The oil opens the check valve and completely fills the plunger cavity.

When cam rotation begins to raise the lifter body, the check valve is closed by its spring plus the increasing pressure exerted on the oil in the plunger cavity. With oil now trapped within the plunger cavity, further cam rotation causes the lifter assembly to move as a solid unit and open the valve. The cycle is repeated when the engine valve closes again.

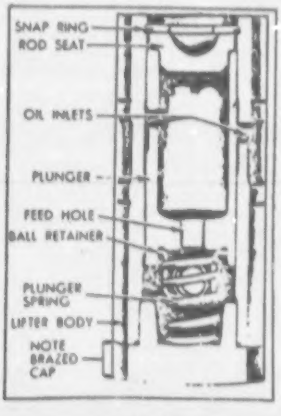


Fig. 21.

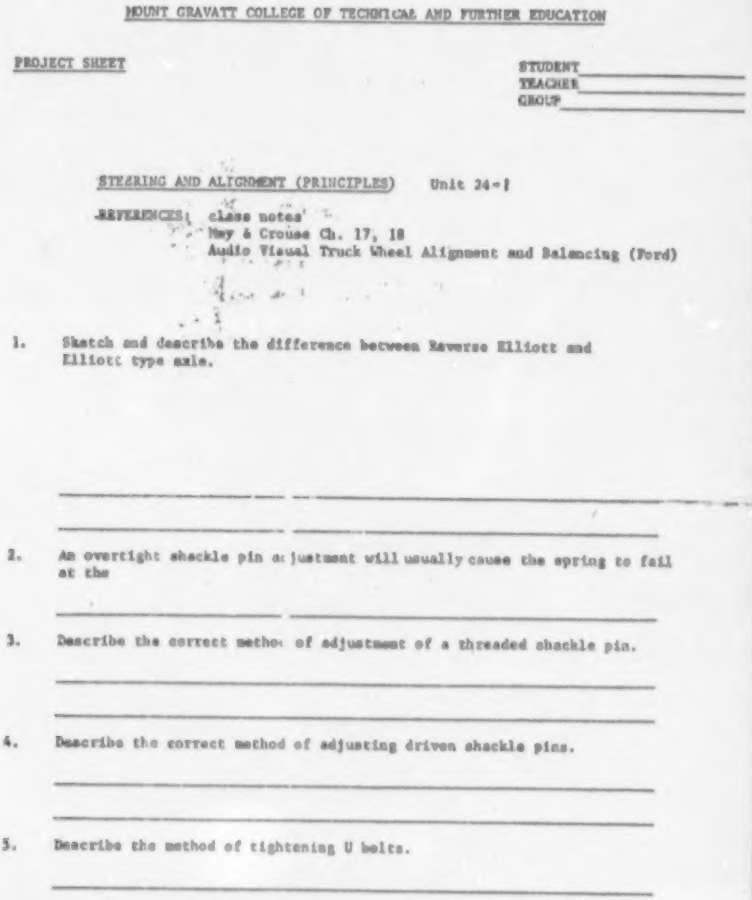
APPENDIX 'A'

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III. (h)	Queensland Department of Technical and Further Education (T.A.F.E.) *Mount Gravatt College Project Sheet*
Purpose	Study Exercises
Description	Theory
Readability Estimate	N/a.

Sample



MOUNT GRAVATT COLLEGE OF TECHNICAL AND FURTHER EDUCATION

PROJECT SHEET

STUDENT ______________________
TEACHER ______________________
GROUP ________________________

STEERING AND ALIGNMENT (PRINCIPLES) Unit 24-1

REFERENCES; class notes
May & Crouse Ch. 17, 18
Audio Visual Truck Wheel Alignment and Balancing (Ford)

1. Sketch and describe the difference between Reverse Elliott and Elliott type axle.

____

____

2. An overtight shackle pin adjustment will usually cause the spring to fail at the

____

3. Describe the correct method of adjustment of a threaded shackle pin.

____

____

4. Describe the correct method of adjusting driven shackle pins.

____

____

5. Describe the method of tightening U bolts.

____

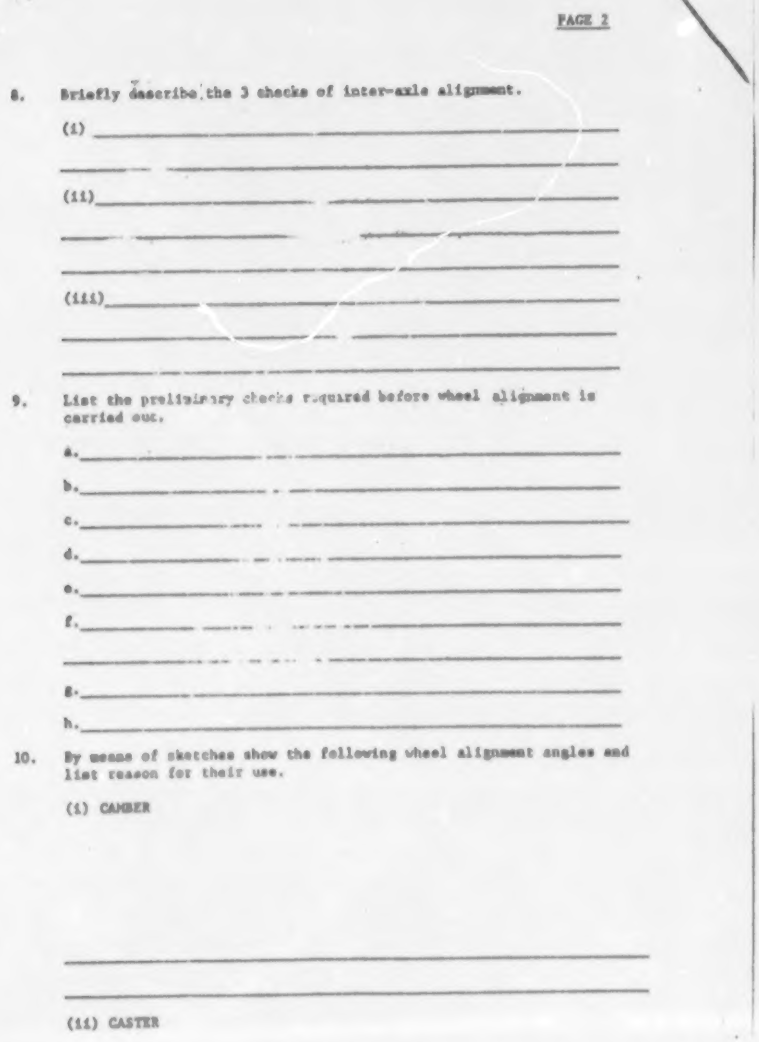
III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III (h)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Mount Gravatt College Project Sheet
(continued)

Sample (continued)



PAGE 2

8. Briefly describe the 3 checks of inter-axle alignment.

(i) ____________________

(ii) ____________________

(iii) ____________________

9. List the preliminary checks required before wheel alignment is carried out.

a. ____________________
b. ____________________
c. ____________________
d. ____________________
e. ____________________
f. ____________________
g. ____________________
h. ____________________

10. By means of sketches show the following wheel alignment angles and list reason for their use.

(i) CAMBER

____

(ii) CASTER

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III (h)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Mount Gravatt College Project Sheet
(continued)

Sample (continued)

PAGE 3

(iii) TOE-IN

(iv) KING PIN INCLINATION

11. The term"steering angle"denotes

TEACHER______________

12. How is caster angle adjusted on a vehicle fitted with leaf springs?

13. Explain the benefit and disadvantages of"cold bending"axle components.

14. What precaution must be taken when heating axle components?

15. Should this precaution be disregarded, what effect would it have on the component?

III. MOTOR MECHANICS

LITERACY AT COLLEGE

Document III (h)

Queensland Department of Technical and Further Education (T.A.F.E.)

Sample (continued)

Mount Gravatt College Project Sheet (continued)

PAGE 4

16. List 4 advantages claimed for power assisted steering.

(i)______________________________

____

(ii)______________________________

____

(iii)______________________________

____

(iv)______________________________

____

17. The 2 basic types of power assisted steering are

(i)______________________________

(ii)______________________________

18. The purpose of a control valve in a power assisted steering is to

____

19. With reference to linkage type power assisted steering describe fluid flow in the straight ahead position.

____

____

____

20. The correct fluid for power assisted steering is

____

21. What precaution must be taken before driving a vehicle without oil in the power steering?

____

PHC 311 Unit 4.

ASSESSMENT____________________ TEACHER____________________

TIME AND DATE COMMENCED____________________

TIME AND DATE COMPLETED____________________

DURATION____________________

IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IV. (a)	Plans/Drawings/Job Specifications
Document IV. (b)	Gyprock Technical Data Sheet
Document IV. (c)	*Australian Standard S.A.A. Steel Structures Code A.S. 1250 D.5 Metalwork.*
Document IV. (d)	*Carpentry and Joinery Basic Training Manual (1980)* Canberra: Australian Government Publishing Service.
Document IV. (e)	Queensland Building Act, 1975.
Document IV. (f)	*Australian Standard 1684 1979 S.A.A. Timber Framing Code.*

LITERACY AT COLLEGE

Document IV. (g)	Queensland Department of Technical and Further Education (T.A.F.E.) *Carpentry and Joinery Notes*

IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS - TRADE JOURNALS

Concrete Construction

Building (U.K.)

Queensland Master Builders

Building Materials and Equipment

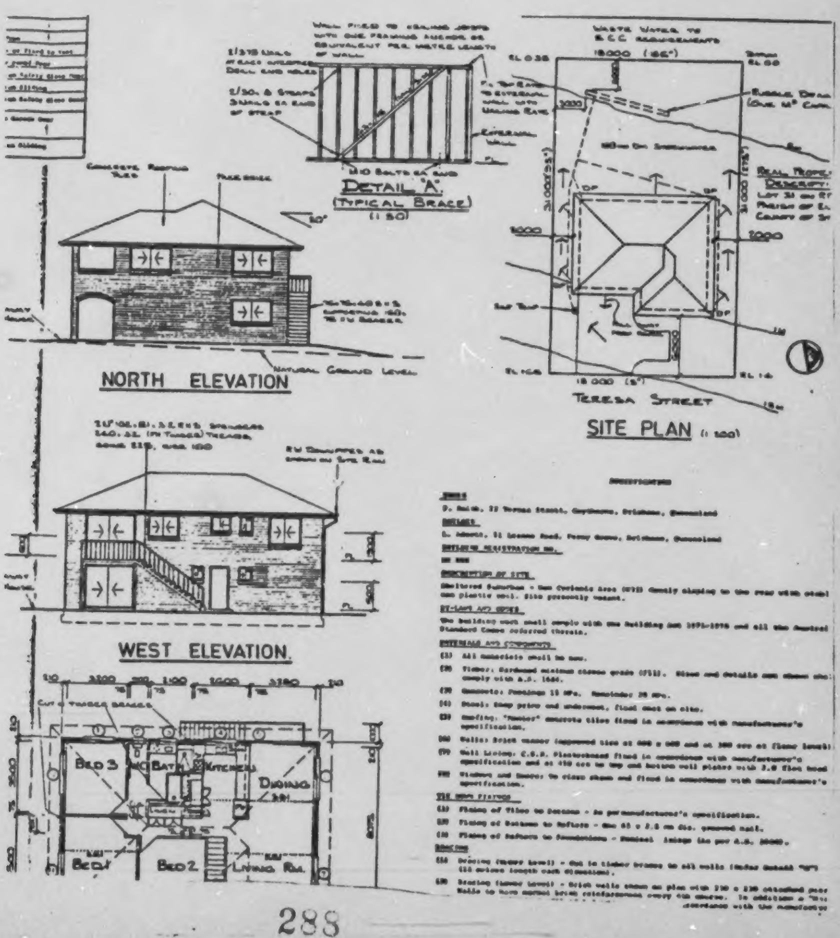
APPENDIX 'A'

IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IV. (a)	*Plans/Drawings/Job Specifications*
Purpose	Detailed Job Instruction
Description	
Readability Estimate	N/a
Sample	



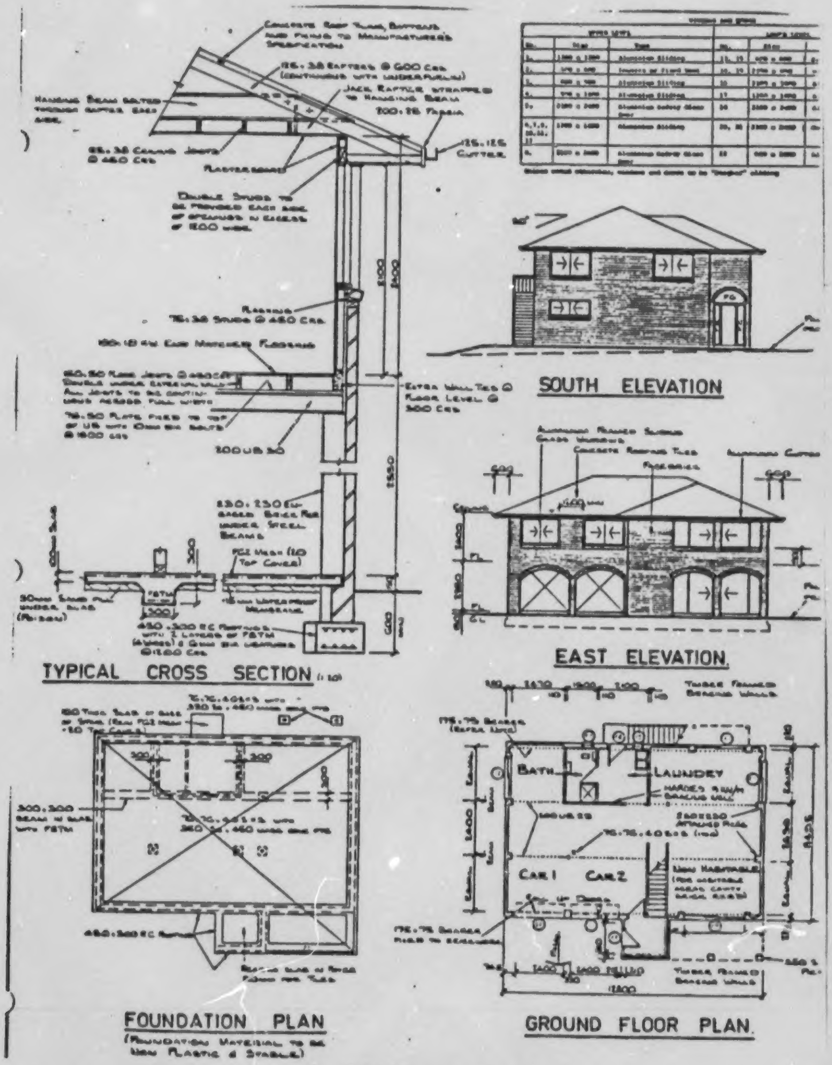
IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IV. (a) *Plans/Drawings/Job Specifications* (contd.)

Sample (continued)


Concrete Roof Tiles, Battens and Fixing to Manufacturer's Specification
125 x 38 Rafters @ 600 Crs.
Jack Rafter Strapped to Hanging Beam
200 x 25 Fascia
125 x 125 Gutter
Plasterboard
Double Studs to be provided each side of openings in excess of 1500 wide
100 x 19 Fl. End Matched Flooring
Extra Wall Ties @ Floor Level @ 300 Crs.
200UB30
TYPICAL CROSS SECTION
SOUTH ELEVATION
EAST ELEVATION
FOUNDATION PLAN
GROUND FLOOR PLAN
BATH
LAUNDRY
CAR 1
CAR 2

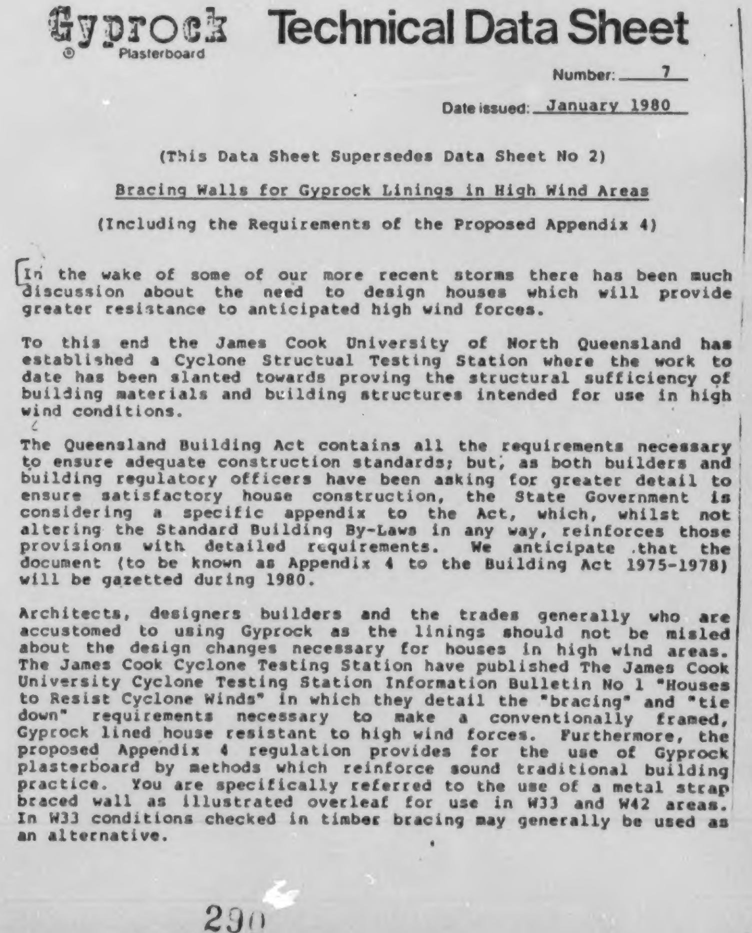
APPENDIX 'A'

IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IV. (b)	*Gyprock Technical Data Sheet*
Purpose	Updating Information
Description	Standards & Specifications
Readability Estimate	13
Sample	



Gyprock ® Plasterboard **Technical Data Sheet**

Number: 7

Date issued: January 1980

(This Data Sheet Supersedes Data Sheet No 2)

Bracing Walls for Gyprock Linings in High Wind Areas

(Including the Requirements of the Proposed Appendix 4)

In the wake of some of our more recent storms there has been much discussion about the need to design houses which will provide greater resistance to anticipated high wind forces.

To this end the James Cook University of North Queensland has established a Cyclone Structual Testing Station where the work to date has been slanted towards proving the structural sufficiency of building materials and building structures intended for use in high wind conditions.

The Queensland Building Act contains all the requirements necessary to ensure adequate construction standards; but, as both builders and building regulatory officers have been asking for greater detail to ensure satisfactory house construction, the State Government is considering a specific appendix to the Act, which, whilst not altering the Standard Building By-Laws in any way, reinforces those provisions with detailed requirements. We anticipate that the document (to be known as Appendix 4 to the Building Act 1975-1978) will be gazetted during 1980.

Architects, designers builders and the trades generally who are accustomed to using Gyprock as the linings should not be misled about the design changes necessary for houses in high wind areas. The James Cook Cyclone Testing Station have published The James Cook University Cyclone Testing Station Information Bulletin No 1 "Houses to Resist Cyclone Winds" in which they detail the "bracing" and "tie down" requirements necessary to make a conventionally framed, Gyprock lined house resistant to high wind forces. Furthermore, the proposed Appendix 4 regulation provides for the use of Gyprock plasterboard by methods which reinforce sound traditional building practice. You are specifically referred to the use of a metal strap braced wall as illustrated overleaf for use in W33 and W42 areas. In W33 conditions checked in timber bracing may generally be used as an alternative.

APPENDIX 'A'

IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IV. (c)	*Australian Standard S.A.A. Steel Structures Code AS.12.50 D.5 Metalwork*
Purpose	Detailed Job Instructions
Description	Standards and Specifications
Readability Estimate	12

Sample

D5. METALWORK

D5.01 MATERIALS – STANDARDS

Structural steel should comply with Australian Standard SAA Steel Structures Code, A.S.1250.

D5.02 MATERIALS – PROPERTIES AND PROBLEMS

Mild steel is a dense homogenous material capable of carrying high loads both in compression and in tension. Because of its high strength, structural members may, from a strength point of view, be of a comparatively small size. However, because excessive vibration and deflection are unacceptable in domestic construction, many members, such as bearers and lintels, must be increased in size to reduce deflections and vibrations to an acceptable level.

The steel stringers, bearers and lintels provided for in this manual are designed with deflection and vibration in mind,however, for particularly sensitive house owners, sizes one above the minimums provided herein could be considered. It should be realised, when considering the problem of deflection and vibration, that a beam supported over three or more supports (i.e. a continuous beam) will have in the order of one third the deflection of a beam supported on two supports (i.e. a simply supported beam).

D5.03 CORROSION PROTECTION

Steel in sheltered internal locations will not be adversely affected by the weather and may generally be left unfinished, though it is recommended that it be painted with a metal primer.

(a) Interior members

Interior steel members, including steel lintels, should be wire-brushed to remove loose scale and finished with one coat of zinc-chromate or other good quality metal primer.

(b) Exterior members

A three-coat finish, i.e. primer, undercoat and enamel, provides a high degree of protection to steel members located outside the building. However, exterior members including lintels and other steel members in external brick walls exposed to aggressive environments, e.g. heavy chemical or marine atmospheres, require more elaborate protective treatment.

In exposed locations, particularly when in contact with the ground and/or corrosive atmospheres, it will rapidly deteriorate by rusting if left unprotected.

Members that are visible in the finished structure may be decorated by the addition of an undercoat and a finishing coat of household enamel.

Probably the simplest and most economic way of protecting steel is to have it hot-dip galvanised. This process, which includes pre-cleaning and descaling, deposits a heavy layer of metallic zinc which will then protect the steelwork by sacrificial action.

Other effective methods of protecting the steel include:

1. Encasing in 50 mm thick concrete after rapping the steel with 5 mm dia wire at 150 mm pitch;
2. Applying hot zinc, aluminium spray or zinc rich coating not less than 127 micrometres thick; or
3. Applying a good quality epoxy or tar epoxy finish;

The finishes should be applied only after the steel has been thoroughly cleaned.

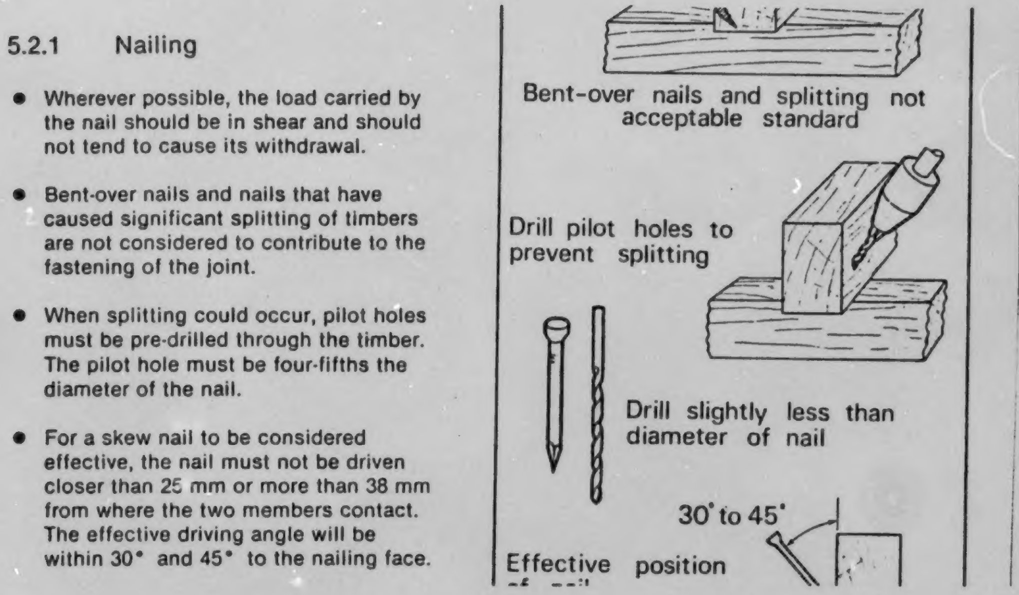
IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IV.(d)	*Carpentry and Joinery Basic Training Manual.* (1980). Canberra: Australian Government Publishing Service
Purpose	Detailed Job Instruction
Description	Theory, procedural directions
Readability Estimate	10.8

Sample



5.2.1 Nailing

- Wherever possible, the load carried by the nail should be in shear and should not tend to cause its withdrawal.
- Bent-over nails and nails that have caused significant splitting of timbers are not considered to contribute to the fastening of the joint.
- When splitting could occur, pilot holes must be pre-drilled through the timber. The pilot hole must be four-fifths the diameter of the nail.
- For a skew nail to be considered effective, the nail must not be driven closer than 25 mm or more than 38 mm from where the two members contact. The effective driving angle will be within 30° and 45° to the nailing face.

Bent-over nails and splitting not acceptable standard

Drill pilot holes to prevent splitting

Drill slightly less than diameter of nail

30° to 45°

Effective position

Comment	Very few passages of straight print - mostly note form with extensive use of illustrations and diagrams.

APPENDIX 'A'

IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

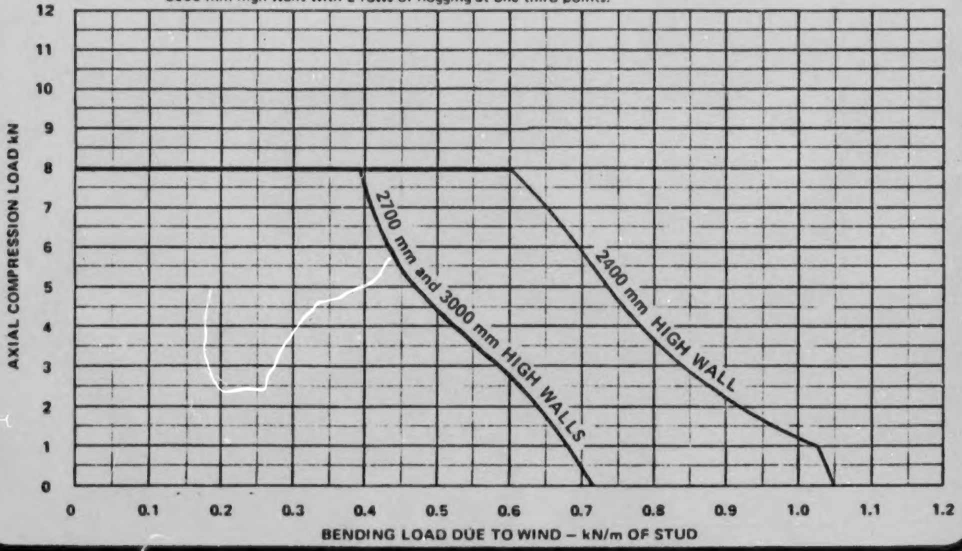
LIST OF READING MATERIALS

Document IV. (e)	Queensland Building Act, 1975.
Purpose	Detailed Job Instruction
Description	Standards and specifications
Readability Estimate	11

Sample

FIG. 2 ALLOWABLE COMBINED AXIAL COMPRESSION LOAD AND BENDING LOAD DUE TO WIND FOR SINGLE 75 mm x 32 mm x 1.2 mm STUDS WITH 33 mm x 5 mm FLARED SERVICE HOLES

Notes:
1. Cladding not considered to brace the studs.
2. Bending load due to wind (kN/m of stud) = stud spacing (m) x design wind pressure (kPa)
3. Graph includes 0.75 load factor in accordance with AS. 1250-1975, Cl. 3.3.1.
4. For brick veneer construction design wind pressure at external walls must be calculated using a 1.4 total wind pressure coefficient.
5. Graph applicable for 2400 and 2700 mm high walls with one row of midheight nogging, or for 3000 mm high walls with 2 rows of nogging at one third points.



APPENDIX 'A'

IV. CARPENTERS AND JOINERS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IV. (f)	*Australian Standard 1684 1979* *S.A.A. Timber Framing Code*
Purpose	Detailed Job Instruction
Description	Standards and specifications
Readability Estimate	9.9

Sample

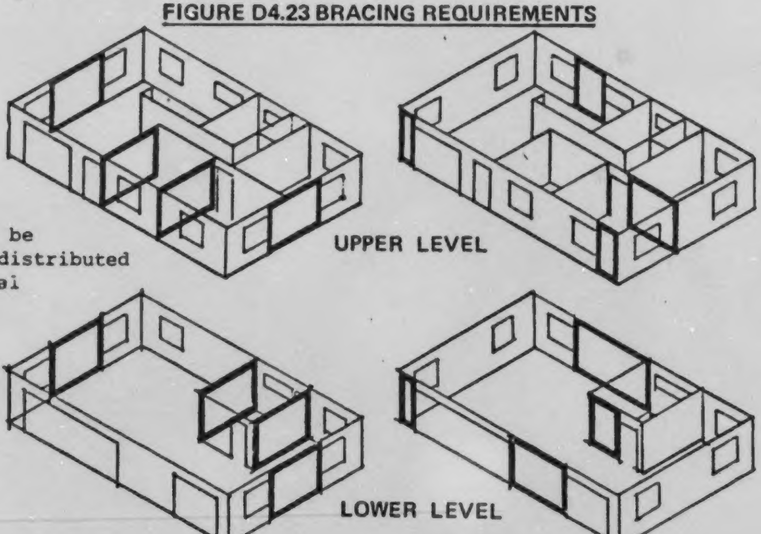
D4.14 BRACING REQUIREMENTS

(a) Bracing system

All buildings should be braced against horizontal wind forces at all levels in order to transfer such forces to the foundation. The bracing should be located at approximately right angles to both the long and short sides of the building in accordance with Figure D4.23.

The type and number of bracing walls or other bracing methods may be determined by reference to Part C "Construction Theory" or by reference to the typical examples given below.

FIGURE D4.23 BRACING REQUIREMENTS



bracing to be
as evenly distributed
as practical

Bracing at right angles to long side

Bracing at right angles to short side

APPENDIX 'A'

IV. CARPENTERS AND JOINERS

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document IV. (g)	Queensland Department of Technical and Further Education (T.A.F.E.) *Carpentry and Joinery Notes*
Purpose	College Notes
Description	Theory, Standards and Specifications, Procedural Directions
Readability Estimate	10.1

Sample

-1- 22 PCJ201-3-1

DEPARTMENT OF EDUCATION, TECHNICAL EDUCATION BRANCH

CARPENTRY AND JOINERY THEORY II

TOPIC 3

TIMBERING OF EXCAVATIONS.

FOUNDATIONS AND TIMBERING.

General Terms. The term "foundations" relates to the ground upon which a building rests.

The term "footings" relates to the lower support of a building, which may be made of brick, stone, or concrete, laid in excavations or trenches made in the earth. Almost all trenches require supports to their sides to prevent caving-in upon the workmen. The various linings, props, and shores used for this purpose are collectively termed the "timbering".

Position and Extent of Timbering. The walls of excavations need temporary support varying degree from nothing to close boarding.

The following points will influence the necessity and type of timbering used in excavations:

1. Types of ground; (a) good, (b) indifferent or doubtful, and (c) bad or treacherous.
2. The depth of the cut. (Affects sizes rather than arrangement of members).
3. The length of time the cut will be open.
4. The influence of weather condition.
5. Any vibration from neighbouring traffic or machinery.
6. Nearness of other buildings (could cause stress on trench walls).
7. Nature of construction of work to be carried out in the trenches.

IV. CARPENTERS AND JOINERS

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document IV (g)

Queensland Department of Technical
and Further Education (T.A.F.E.)

Carpentry and Joinery Notes (continued)

Sample (continued)

Proportions			Litres water per bag of cement		Yield	Uses for Mixes
$0.026m^3$ bag of cement	$0.026m^3$ clean sand slightly damp	$0.026m^3$ screening of gravel	Stiff mix-fairly dry	Workable mix-wet	Of Mixture in m^3	
1	3	-	19	22	0.07	Wall plaster ornaments, sandsto texture, roughcast and stucco.
1	2.5	-	16	19	0.06	Surface layer for paths, drives and tennis courts. Grout for penetration roads.
1	2	-	16	18	0.05	Water-tight plaster coats for cellars and tanks; walls for kitchens and diaries; structural brickwork.
1	-	2.5	14	16	0.06	Terrazzo floors and walls. Aggregates are marble chips - no sand, Finish by grinding.

IV. CARPENTERS AND JOINERS

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document IV. (q)

Queensland Department of Technical
and Further Education (T.A.F.E.)

Carpentry and Joinery Notes (continued)

Sample (continued)

CONCRETE CALCULATIONS

Proportions			Litres water per bag of cement		Yield	
0.026m^3 bag of cement	0.026m^3 clean sand slightly damp	0.026m^3 screening of gravel	Stiff mix-fairly dry	Workable mix-wet	Of Mixture in m^3	Uses for mixes
1	1	3	16	18	0.08	Heavy duty floor for factories and dairies. Aggregates exposed as surface.
1	2	3	18	21	0.10	High structural strength roads, water tanks, wells, pipes, and sewerage works.
1	2.5	4	23	29	0.13	General structural concrete buildings, roads, slabs and pavement, tennis courts, posts and silos.
1	3	5	32	35	0.15	Foundations and large masses of concrete, heavy walls, large engine bases, buttresses and weights.
1	2	4	21	26	0.12	Specification concrete-City building regulations.
1	5	-	26	28	0.12	Building blocks and bricks, semi-damp cement sand mixtures will not resist damp.
1	4	-	22	25	[illegible]	[illegible]

V. PAINTERS AND DECORATORS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document V. (a)	Spartan Paints Architectural Finishes (Melbourne) *Product Information Sheet*
Document V. (b)	Spartan Paints Architectural Finishes (Melbourne) *Paint Failure Information Sheet*

LITERACY AT COLLEGE

Document V. (c)	Queensland Department of Technical and Further Education (T.A.F.E.) Notes. *Painting and Decorating Course*

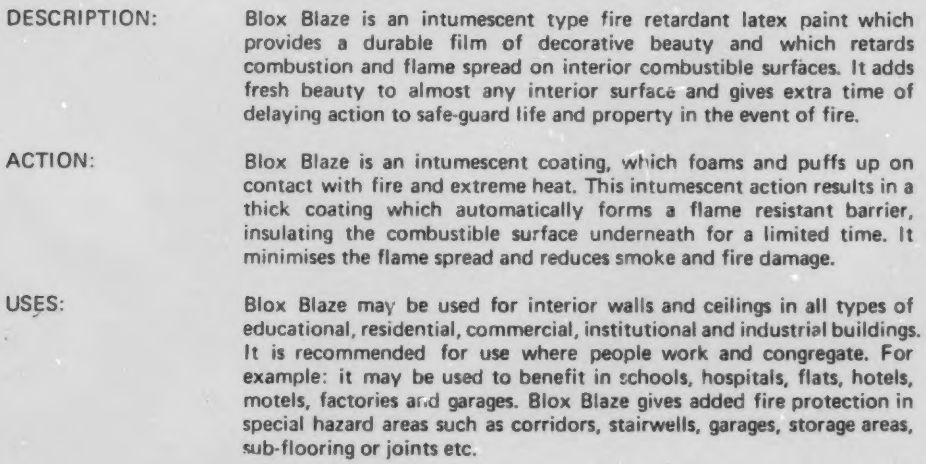
V. PAINTERS AND DECORATORS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document V. (a)	Spartan Paints Architectural Finishes (Melbourne) *Product Information Sheet*
Purpose	Detailed Job Instruction
Description	Standards and Specifications
Readability Estimate	13.5

Sample



DESCRIPTION: Blox Blaze is an intumescent type fire retardant latex paint which provides a durable film of decorative beauty and which retards combustion and flame spread on interior combustible surfaces. It adds fresh beauty to almost any interior surface and gives extra time of delaying action to safe-guard life and property in the event of fire.

ACTION: Blox Blaze is an intumescent coating, which foams and puffs up on contact with fire and extreme heat. This intumescent action results in a thick coating which automatically forms a flame resistant barrier, insulating the combustible surface underneath for a limited time. It minimises the flame spread and reduces smoke and fire damage.

USES: Blox Blaze may be used for interior walls and ceilings in all types of educational, residential, commercial, institutional and industrial buildings. It is recommended for use where people work and congregate. For example: it may be used to benefit in schools, hospitals, flats, hotels, motels, factories and garages. Blox Blaze gives added fire protection in special hazard areas such as corridors, stairwells, garages, storage areas, sub-flooring or joints etc.

Comment	Contains a high proportion of densely written technical language.

APPENDIX 'A'

V. PAINTERS AND DECORATORS

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document V. (b)	Spartan Paints Architectural Finishes (Melbourne) *Paint Failure Information Sheet*
Purpose	Problem Solving
Description	Procedural directions Standards and specifications
Readability Estimate	10.5

Sample

Symptoms

1. Premature loss of colour on exterior finishes.
2. Spot fading on masonry or plaster surfaces.

Causes

1. Ultra-violet rays of sun on the pigment. This causes the greater proportion of complaints.
2 Chalking of exterior surfaces. This is not really fading; it is apparent fading.
3. An alkaline surface causing what we know as a lime bleach.
4. Using a colour designated for interior use only on an exterior surface.

Comment	Most information presented in point form.

APPENDIX 'A'

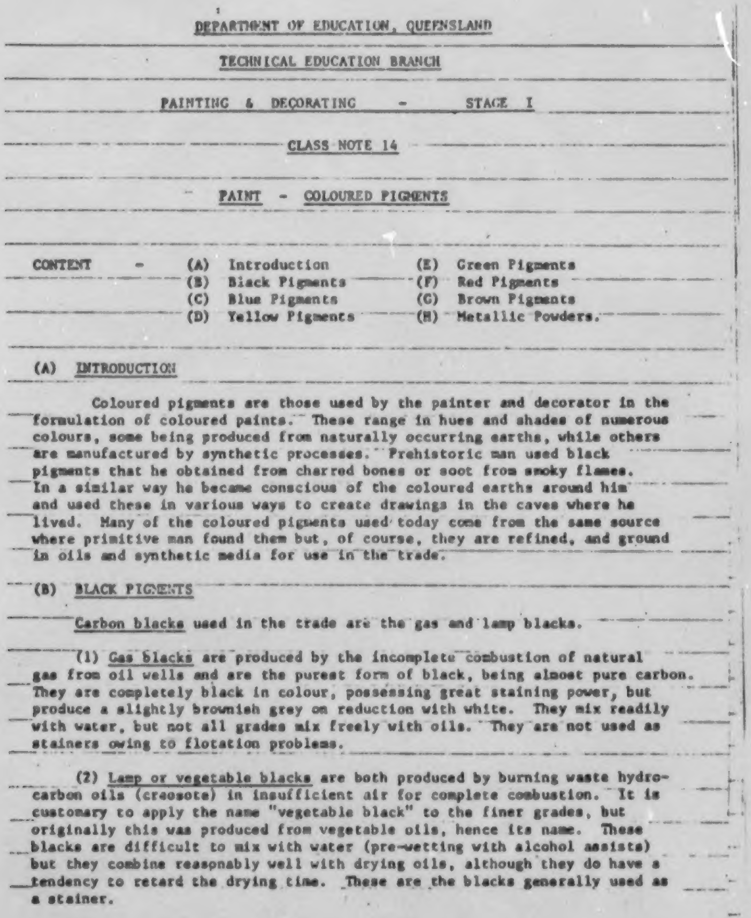
V. PAINTERS AND DECORATORS

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document V. (c)	Queensland Department of Technical and Further Education (T.A.F.E.) Notes. *Painting and Decorating*
Purpose	College Notes
Readability Estimate	9.2
Description	Theory Standards and Specifications Procedural Directions

Sample



DEPARTMENT OF EDUCATION, QUEENSLAND

TECHNICAL EDUCATION BRANCH

PAINTING & DECORATING - STAGE I

CLASS NOTE 14

PAINT - COLOURED PIGMENTS

CONTENT -	(A) Introduction	(E) Green Pigments
	(B) Black Pigments	(F) Red Pigments
	(C) Blue Pigments	(G) Brown Pigments
	(D) Yellow Pigments	(H) Metallic Powders.

(A) INTRODUCTION

Coloured pigments are those used by the painter and decorator in the formulation of coloured paints. These range in hues and shades of numerous colours, some being produced from naturally occurring earths, while others are manufactured by synthetic processes. Prehistoric man used black pigments that he obtained from charred bones or soot from smoky flames. In a similar way he became conscious of the coloured earths around him and used these in various ways to create drawings in the caves where he lived. Many of the coloured pigments used today come from the same source where primitive man found them but, of course, they are refined, and ground in oils and synthetic media for use in the trade.

(B) BLACK PIGMENTS

Carbon blacks used in the trade are the gas and lamp blacks.

(1) Gas blacks are produced by the incomplete combustion of natural gas from oil wells and are the purest form of black, being almost pure carbon. They are completely black in colour, possessing great staining power, but produce a slightly brownish grey on reduction with white. They mix readily with water, but not all grades mix freely with oils. They are not used as stainers owing to flotation problems.

(2) Lamp or vegetable blacks are both produced by burning waste hydrocarbon oils (creosote) in insufficient air for complete combustion. It is customary to apply the name "vegetable black" to the finer grades, but originally this was produced from vegetable oils, hence its name. These blacks are difficult to mix with water (pre-wetting with alcohol assists) but they combine reasonably well with drying oils, although they do have a tendency to retard the drying time. These are the blacks generally used as a stainer.

APPENDIX 'A'

V. PAINTERS AND DECORATORS

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document V. (c)

Queensland Department of Technical
and Further Education (T.A.F.E.) Notes
Painting and Decorating (continued)

Sample (continued)

COLOUR PIGMENT	COLOUR FASTNESS	AFFECTED BY		STAINING STRENGTH	GENERAL REMARKS
		ACIDS	ALKALIS		
Gas Blacks	Very Good	No	No	Not Recommended	Tends to Float as a stainer
Lamp & Vegetable blacks	Very Good	No	No	Good	Good stainer for oil paints (tends to float)
Bone, Drop & Ivory Blacks	Very Good	No	No	Very Good	Good stainer for all paints (no flotation)
Graphite Blacks	Very Good	No	No	Poor	Excellent for Roof paints (tends to become slippery on ageing)
Iron Oxide Blacks	Very Good	No	No	Not Recommended	Good for metal primers, form hard films
Ultramarine Blue	Very Good	Yes	No	Not Recommended	Used extensively in water paints.
Prussian Blue	Reasonable	No	Yes	Very Good	Tend to fade when used as a stainer
Phthalocyanine Blue	Excellent	No	No	Excellent	Colour almost true spectral blue
Indanthrone Blue	Excellent	No	No	Excellent	Superior to Phthalocyanine, but expensive
Chrome Yellow	Reasonable	No	Yes	Very Good	Exposure to sulphur gases cause sulphur staining
Zinc Chromate	Excellent	Yes	No	Poor	Used in anti-corrosives & etching primers
Yellow Ochre	Excellent	No	No	Very Good	Dull-Dirty yellow
RawSienna	Excellent	No	No	Poor	Dull, but good for stains and glazing mixtures.
Iron Oxide Yellow	Excellent	Yes	No	Very Good	Colours vary but usually dull
Cadium Yellow	Very Good	Yes	No	Not Recommended	Very expensive. Good artists colour
Organic Yellow	Very Good	No	No	Very Good	Belong to "Azo" Group include Benzidine Arylamide Hansa Yellow
Phthalocyanine Green	Excellent	No	No	Excellent	Undoubtedly the best green pigment

V. PAINTERS AND DECORATORS

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document V.(c)

Queensland Department of Technical and Further Education (T.A.F.E.) Notes. *Painting and Decorating (continued)*

Sample (continued)

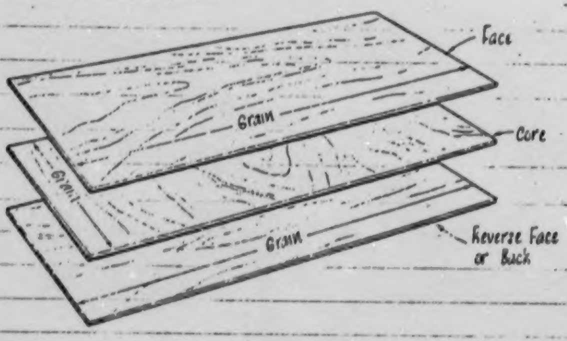
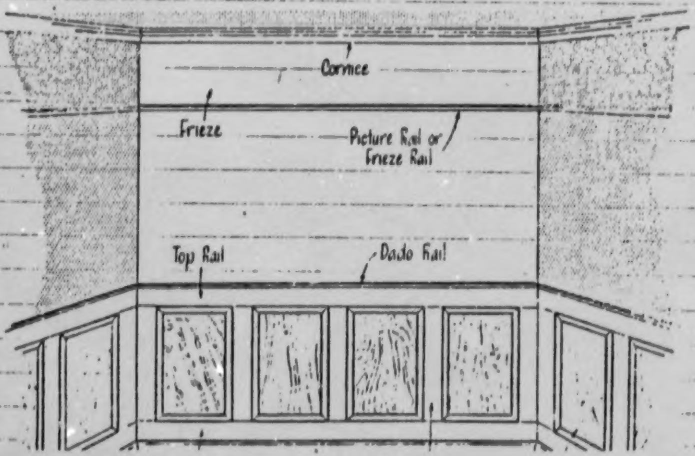


Fig. 2 3-ply Construction



VI. COOKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VI. (a)	Sample Menu
Document VI. (b)	Function Booking Sheet
Document VI. (c)	Revenue Summary Sheet
Document VI. (d)	Cracknell, H. and Kaufmann, R. (1972) *Practical Professional Cookery.* London: MacMillan Press.

LITERACY AT COLLEGE

Document VI. (d)	Cracknell, H. and Kaufmann, R. (1972) *Practical Professional Cookery.* London: MacMillan Press
Document VI. (e)	Queensland Department of Technical and Further Education (T.A.F.E.) *Cooking Notes*

APPENDIX 'A'

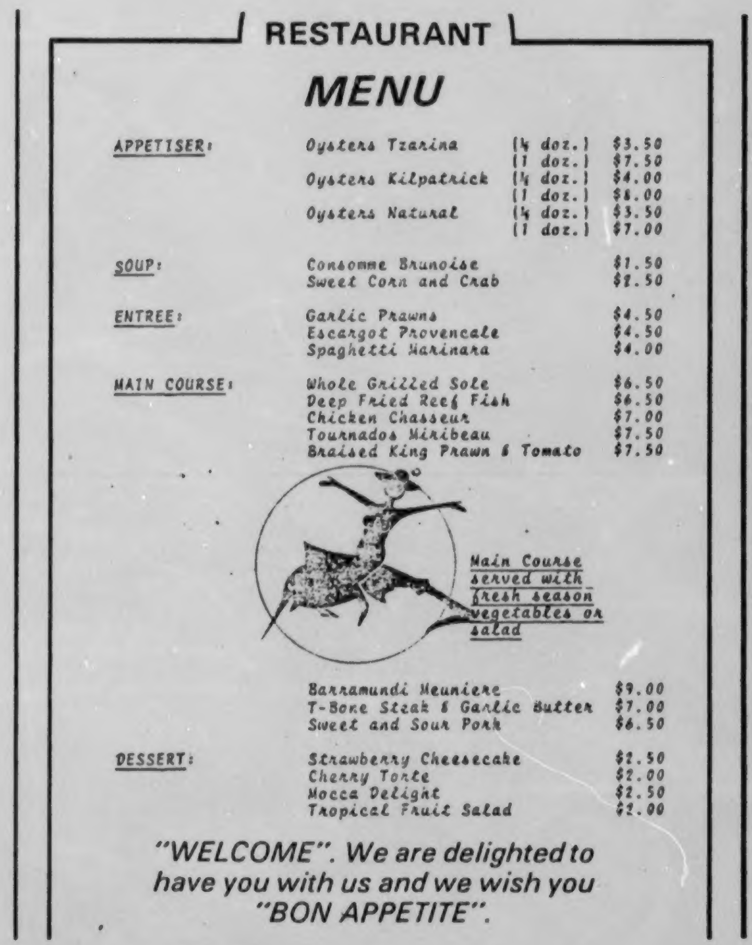
VI. COOKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VI. (a)	Sample Menu.
Purpose	Job Allocation
Description	Functional Description
Readability Estimate	N/a

Sample



RESTAURANT

MENU

APPETISER:	Oysters Tzarina	(¼ doz.)	$3.50
		(1 doz.)	$7.50
	Oysters Kilpatrick	(¼ doz.)	$4.00
		(1 doz.)	$8.00
	Oysters Natural	(¼ doz.)	$3.50
		(1 doz.)	$7.00
SOUP:	Consomme Brunoise		$1.50
	Sweet Corn and Crab		$2.50
ENTREE:	Garlic Prawns		$4.50
	Escargot Provencale		$4.50
	Spaghetti Marinara		$4.00
MAIN COURSE:	Whole Grilled Sole		$6.50
	Deep Fried Reef Fish		$6.50
	Chicken Chasseur		$7.00
	Tournados Miribeau		$7.50
	Braised King Prawn & Tomato		$7.50
	Barramundi Meuniere		$9.00
	T-Bone Steak & Garlic Butter		$7.00
	Sweet and Sour Pork		$6.50
DESSERT:	Strawberry Cheesecake		$2.50
	Cherry Torte		$2.00
	Mocca Delight		$2.50
	Tropical Fruit Salad		$2.00

Main Course served with fresh season vegetables or salad

"WELCOME". We are delighted to have you with us and we wish you "BON APPETITE".

APPENDIX 'A'

VI. COOKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VI. (b)	Function Booking Sheet
Purpose	Job Allocation
Description	Functional Description
Readability Estimate	N/a

Sample

DATE: WEDNESDAY, 17th JUNE, 1981.
ARRIVAL TIME: 11.30 a.m.
ATTENDANCE: 12
TYPE OF FUNCTION:
PRE-DINNER DRINKS AT:
~~DINNER~~ TO BE SERVED AT: 1.00 p.m.

NAME OF FUNCTION: C.B.C. BANK
ORGANISER'S NAME: MR. G. WHITING
PHONE: 71 6839
ADDRESS: 336 FLINDERS STREET, TOWNSVILLE.
ACCOUNT:
ROOM HIRE: $50
MAGNETIC

BEVERAGE REQUIREMENTS:
BAR TO BE READY AT:

FULL BAR CHARGE ACCOUNT

CATERING REQUIREMENTS:
MENU

1.00 p.m. AVOCADO PRAWN COCKTAIL

BARRAMUNDI, LEMON BUTTER PARSLEY SAUCE
FRIED POTATOES TOWNSVILLE PLUS CARROTS
AND GREEN SALAD

CHEESE AND CRACKERS

COFFEE/TEA/MINTS

WINES TO BE SERVED DURING DINNER:

SPECIAL REQUIREMENTS:
BLACKBOARD
EASELS
LECTERN
FLOWERS
MICROPHONE

~~SLIDE~~ OVERHEAD PROJECTOR
MOVIE
SCREEN YES
CHALK, DUSTERS
STAGE

SETTING INSTRUCTIONS:
OFFICIAL TABLE FOR:
TABLES OF:
SHAPE:
CIGARS:
PLACE CARDS:
TABLE NUMBERS:

APPENDIX 'A'

VI. COOKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VI. (c) Revenue Summary Sheet

Purpose

Description Procedural Check List

Readability Estimate Not applicable

Sample

REVENUE SUMMARY SHEET: CATERING DEPT.

DATE:

BISTRO

BFAST:
NO MEALS
R/S
CASH
CHARGE
CASH AMOUNT
CHARGE AMOUNT

LUNCH:
NO. MEALS
R/S
CASH
CHARGE
CASH AMOUNT
CHARGE AMOUNT

DINNER:
NO. MEALS
R/S
CASH
CHARGE
CASH AMOUNT
CHARGE AMOUNT

TOTAL

STAFF COST

BISTRO PERM.
BISTRO CAUS.
REST. PERM.
REST. CAS.
KITCHEN PERM.
KITCHEN CAS.
FUNCTION PERM.
FUNCTION CAS.

TOTAL

REGENCY ROOM
NO. PEOPLE

CASH AMOUNT

CHARGE AMOUNT

FUNCTIONS

TOTAL

TOTAL CATERING

APPENDIX 'A'

VI. COOKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VI. (d)	Cracknell, H. and Kaufmann, R. (1972) *Practical Professional Cookery* London: MacMillan Press.
Purpose	Detailed Job Instructions
Description	Theory Procedural Directions
Readability Estimate	Theory: 12.4 Recipes: 9.5
Sample	

4 SAUCES

Sauces play a very important part in cookery, a fact which is exemplified by the standing of the Chef Saucier as the senior chef de partie in the kitchen brigade. A good sauce can enhance the quality of the food with which it is served. In the days before refrigeration, when foods took longer to get from the source of supply to the kitchen, sauces were richer and more highly concentrated than they are today, the reason being that they were often used to disguise the staleness of the meat or fish. Present-day taste is for sauces of a delicate, natural flavour that serve to complement the food they accompany rather than to mask its taste. Some sauces are used to aid the digestion and act as a contrast to the nature of the dish such as when apple sauce is served with roast pork or roast duck. In this case the sauce assists in counteracting the fatty nature of the meat and makes it more easily digestible.

The Chef Saucier is responsible for the preparation of most of the hot sauces served with meat, poultry and game. The Chef Poissonnier is responsible for the sauces served with fish, including Béchamel and Hollandaise. Sauces which accompany roast meat, poultry and game, such as bread sauce and apple sauce, are the responsibility of the Chef Rôtisseur. The Chef Garde-Manger makes all cold sauces, and the Chef Pâtissier makes sweet sauces.

A sauce is a liquid which has been thickened by one or a combination of the following:
(a) A roux—either roux blanc, roux blond or roux brun.
(b) A starch—such as arrowroot or cornflour diluted with water.
(c) Yolks of egg—usually in the form of a liaison.
(d) Beurre manié—butter and flour mixed together.
(e) Butter—softened butter shaken or whisked into a reduced cooking liquor.

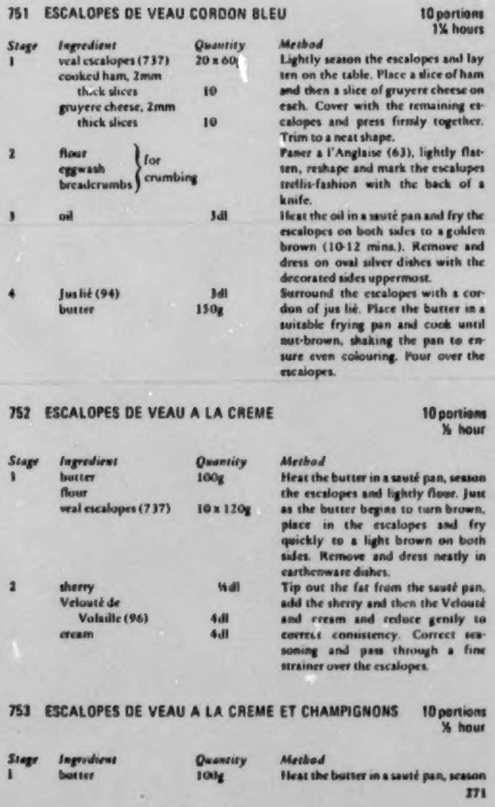
APPENDIX 'A'

VI. COOKING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document VI. (d)	Cracknell, H. and Kaufmann, R. (1972) *Practical Professional Cookery* London: MacMillan Press.
Purpose	Detailed Job Instructions
Description	Theory Procedural Directions
Readability Estimate	Theory: 12.4 Recipes: 9.5
Sample	



751 ESCALOPES DE VEAU CORDON BLEU 10 portions 1¼ hours

Stage	*Ingredient*	*Quantity*	*Method*
1	veal escalopes (737)	20 x 60g	Lightly season the escalopes and lay ten on the table. Place a slice of ham and then a slice of gruyere cheese on each. Cover with the remaining escalopes and press firmly together. Trim to a neat shape.
	cooked ham, 2mm thick slices	10	
	gruyere cheese, 2mm thick slices	10	
2	flour eggwash breadcrumbs } for crumbing		Paner a l'Anglaise (63), lightly flatten, reshape and mark the escalopes trellis-fashion with the back of a knife.
3	oil	3dl	Heat the oil in a sauté pan and fry the escalopes on both sides to a golden brown (10-12 mins.). Remove and dress on oval silver dishes with the decorated sides uppermost.
4	Jus lié (94)	3dl	Surround the escalopes with a cordon of jus lié. Place the butter in a suitable frying pan and cook until nut-brown, shaking the pan to ensure even colouring. Pour over the escalopes.
	butter	150g	

752 ESCALOPES DE VEAU A LA CREME 10 portions ½ hour

Stage	*Ingredient*	*Quantity*	*Method*
1	butter	100g	Heat the butter in a sauté pan, season the escalopes and lightly flour. Just as the butter begins to turn brown, place in the escalopes and fry quickly to a light brown on both sides. Remove and dress neatly in earthenware dishes.
	flour		
	veal escalopes (737)	10 x 120g	
2	sherry	½dl	Tip out the fat from the sauté pan, add the sherry and then the Velouté and cream and reduce gently to correct consistency. Correct seasoning and pass through a fine strainer over the escalopes.
	Velouté de Volaille (96)	4dl	
	cream	4dl	

753 ESCALOPES DE VEAU A LA CREME ET CHAMPIGNONS 10 portions ½ hour

Stage	*Ingredient*	*Quantity*	*Method*
1	butter	100g	Heat the butter in a sauté pan, season

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APPENDIX 'A'

VI. COOKING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document VI. (e)	Queensland Department of Technical and Further Education (T.A.F.E.) *Cooking Notes*
Purpose	College notes
Description	Theory, Procedural Directions, Standards and Specifications
Readability Estimate	11.6

Sample

OFFAL

The word 'offal' comes from off falls' - these parts of slaughtered pigs, cattle or sheep which are left after the carcass has been cut up. Despite the fact that offal includes some of the most appetising and nourishing food to be bought from the butcher, it has always been given a low status among meats, because of its association with scraps waste, and parts that are thrown away. It is even spoken of in the polite Norman French which is used for cuts of meat. This is apparent in terms such as calf's liver and pigs liver, rather than veal liver or pork liver. The Americans use the term 'variety meats' to describe offal, but the name has never caught on in Britain.

Many types of offal - liver for example - are excellent sources of the minerals and vitamins necessary for good health. Much offal - brains, sweetbreads and tripe, to mention a few - is also easily digestible and therefore suitable for a building-up diet.

Ironically, certain types of offal, such as brains and calf's liver and sweetbreads, are considered such gourmet's delicacies that they are often priced out of the market for the average housewife. But generally, offal compares favourably with meat in price. It seldom required lengthy preparation and cooking, and as it contains no bones and little fat or gristle, wastage is cut to the minimum.

Offal does not store well: it should be used on the day of purchase and stored in the refrigerator until prepared for cooking.

Liver: The best and most expensive is calf's liver, the cheapest ox. The latter has the strongest flavour, followed by pig's, lamb's and calf's liver in that order.

Calf's Liver: Pale milky brown in colour and soft to touch. Make sure the burcher removes the inedible main pipes. Imported liver is smaller, similar in colour and less expensive. Grill of fry liver underdone.

Lamb's liver: Less expensive than calf's liver and excellent for frying and grilling. Choose liver light brown in colour and avoid any that is dark brown and therefore from an older animal.

VI. COOKING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document VI. (e)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Cooking Notes (continued)

Sample (continued)

COST AND CONTROL

LESSON 3. GROSS PROFIT. GROSS PROFIT PERCENT.
SELLING PRICE. NET PROFIT.
FOOD COSTING AND CALCULATIONS.

STEP 1.

USING EXAMPLE, explain to the students how to find Gross Profit and Gross Profit %. Explain the importance of using the formula in working out the problems.

STEP 2.

(a) Give the students the first of the problems. Allow time to work out the answer. Go through the answer on the chalkboard and show the students how to set out their answers.

(b) Give the students the second of the problems, allow them time to work out answer. Go through the answer, and show the students now to answer the question, step by step.

STEP 3.

USING EXAMPLE, explain to the students how to find the SELLING PRICE. Explain the importance of using the formula in working out problems.

STEP 4.

Give the students the problems on selling price. Allow time for students to work out the ansers. Go through the answers on the chalkboard.

STEP 5.

USING EXAMPLE, explain to the students how to find the NET PROFIT using given formula.

STEP 6.

Give the students the final problem 6 a,b,c,d,e, which incorporate Food Costing, Selling Price, Gross Profit, Net Profit.

VI. COOKING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document VI. (e)

Queensland Department of Technical
and Further Education (T.A.F.E.)
Cooking Notes (continued)

Sample (continued)

GLOSSARY OF CHEESES

BURRINO:	A cheese closely related to Mozzarella - "Burro" meaning butter in Italian. The cheese has a knob of butter weighing several grammes moulded into the heart of the curd. When sliced in half, Burrino with its centre core of butter presents an attractive contrast of colour, texture and flavour.
CHEDDAR:	(poly-unsaturated) - Similar to Cheddar cheese, but naturally fat-modified with a lower level of saturated fats than most other similar varieties. It was developed by the CSIRO and is to be produced in other countries.
LEYDON: **LEIDON:**	A semi-hard cheese first made at the Dutch town of Leydon. Leydon is spiced with caraway, cloves and cumin, and has a rich, dark yellow texture. Its flavour tends to be rather spicy. It is usually made in round loaves similar to the Gouda cheese.
LIMBURGER:	A semi-soft, surface-ripened cheese with a characteristic strong flavour and aroma. Usually it contains some irregular openings. Limburger was first made in the Province of Limburg, Belgium, and is named after the town of Limburg. Its flavour is robust, piquant and is generally used as a dessert cheese.
MOZZARELLA:	The cheese is another of the "pasta Filata" or such curd family and is made in much the same way as Provolone. Mozzarella, however, is eaten when very young, tender and dripping with its fresh whey. In Australia it is usually matured for about a month and this gives it a soft body and a smooth, close texture. It is easy to grate; it is also the core to that great Neapolitan dish - the pizza. It is formed into fist-sized pear shapes and covered with a heat-shrinkable plastic coating. A cord is attached to the neck and the cheese is tied in pairs. This allows the cheese to be hung and not become mis-shaped during storage.
SWISS:	(Emmenthaler) - Known in Australia simply as Swiss. It originated in the Emme Valley (Emmenthal meaning valley of the Emme in Swiss-German) in Switzerland about the middle of the fifteenth century. It has a smooth, mellow flavour with a characteristic hazelnut, sweetish tang. It can be easily recognised by the large "eyes" made by the expansion of the gas within the curd. Australian Swiss is made in the traditional shape of a flat wheel about 15cm thick and up to 91cm in diameter by one company; another makes it in a 3kg block.

VII. HAIRDRESSING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VII. (a)	Manufacturer's Instruction *L'Oréal*

LITERACY AT COLLEGE

Document VII. (b)	Queensland Department of Technical and Further Education (T.A.F.E.) College *Hairdressing Notes*
Document VII. (c)	*The Van Dean Manual*, 1979. New York: Milady Co.
Document VII. (d)	Barber Styling Text Book Committee, (1977) *Standard Text Book of Professional Barber Styling.* Bronx: Milady Publishing Co.

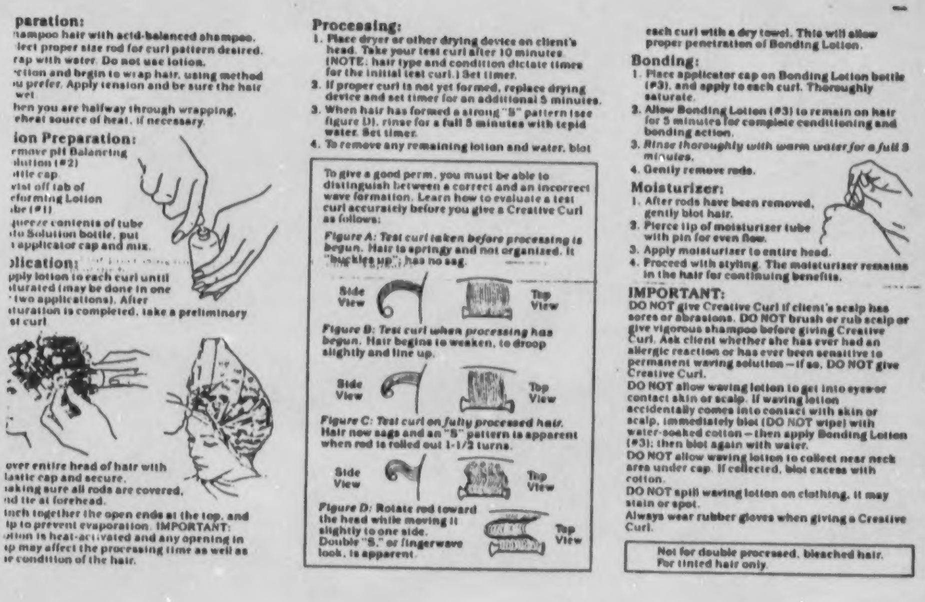
VII. HAIRDRESSING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VII. (a)	Manufacturer's Instruction *L'Oréal*
Purpose	Detailed Job Instruction
Description	Procedural Directions
Readability Estimate	N/a.

Sample



Side View
Top View
Side View
Top View
Side View
Top View
Top View

paration:

1ampoo hair with acid-balanced shampoo.
lect proper size rod for curl pattern desired.
rap with water. Do not use lotion.
ction and begin to wrap hair, using method
u prefer. Apply tension and be sure the hair
wet.
hen you are halfway through wrapping,
eheat source of heat, if necessary.

ion Preparation:

emove pH Balancing
dution (#2)
ttle cap.
vist off tab of
eforming Lotion
be (#1)
queeze contents of tube
to Solution bottle, put
applicator cap and mix.

plication:

pply lotion to each curl until
aturated (may be done in one
two applications). After
aturation is completed, take a preliminary
st curl.

over entire head of hair with
lastic cap and secure,
naking sure all rods are covered,
nd tie at forehead.
inch together the open ends at the top, and
ip to prevent evaporation. IMPORTANT:
otion is heat-activated and any opening in
ap may affect the processing time as well as
ie condition of the hair.

Processing:

1. Place dryer or other drying device on client's head. Take your test curl after 10 minutes. (NOTE: hair type and condition dictate times for the initial test curl.) Set timer.
2. If proper curl is not yet formed, replace drying device and set timer for an additional 5 minutes.
3. When hair has formed a strong "S" pattern (see figure D), rinse for a full 5 minutes with tepid water. Set timer.
4. To remove any remaining lotion and water, blot each curl with a dry towel. This will allow proper penetration of Bonding Lotion.

To give a good perm, you must be able to distinguish between a correct and an incorrect wave formation. Learn how to evaluate a test curl accurately before you give a Creative Curl as follows:

Figure A: Test curl taken before processing is begun. Hair is springy and not organized. It "buckles up"; has no sag.

Figure B: Test curl when processing has begun. Hair begins to weaken, to droop slightly and line up.

Figure C: Test curl on fully processed hair. Hair now sags and an "S" pattern is apparent when rod is rolled out 1-1/2 turns.

Figure D: Rotate rod toward the head while moving it slightly to one side. Double "S," or fingerwave look, is apparent.

Bonding:

1. Place applicator cap on Bonding Lotion bottle (#3), and apply to each curl. Thoroughly saturate.
2. Allow Bonding Lotion (#3) to remain on hair for 5 minutes for complete conditioning and bonding action.
3. *Rinse thoroughly with warm water for a full 5 minutes.*
4. Gently remove rods.

Moisturizer:

1. After rods have been removed, gently blot hair.
2. Pierce tip of moisturizer tube with pin for even flow.
3. Apply moisturizer to entire head.
4. Proceed with styling. The moisturizer remains in the hair for continuing benefits.

IMPORTANT:

DO NOT give Creative Curl if client's scalp has sores or abrasions. DO NOT brush or rub scalp or give vigorous shampoo before giving Creative Curl. Ask client whether she has ever had an allergic reaction or has ever been sensitive to permanent waving solution – if so, DO NOT give Creative Curl.

DO NOT allow waving lotion to get into eyes or contact skin or scalp. If waving lotion accidentally comes into contact with skin or scalp, immediately blot (DO NOT wipe) with water-soaked cotton – then apply Bonding Lotion (#3); then blot again with water.

DO NOT allow waving lotion to collect near neck area under cap. If collected, blot excess with cotton.

DO NOT spill waving lotion on clothing, it may stain or spot.

Always wear rubber gloves when giving a Creative Curl.

Not for double processed, bleached hair.
For tinted hair only.

APPENDIX 'A'

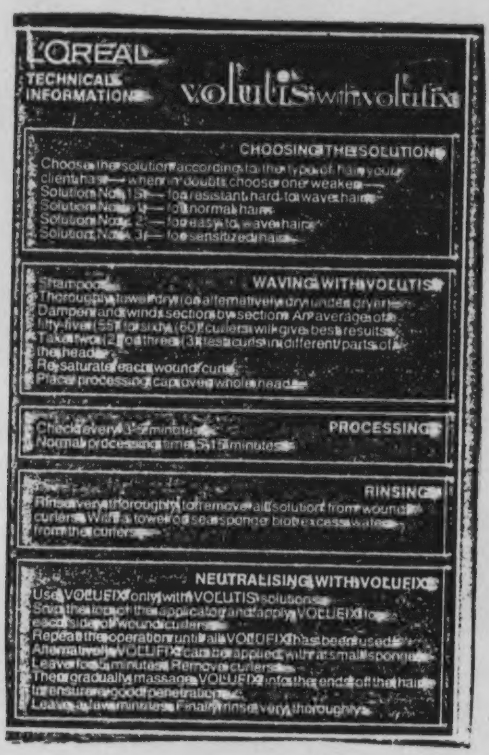
VII. HAIRDRESSING

LITERACY ON THE JOB

LIST OF READING MATERIALS

DOCUMENT VII. (a) Manufacturer's Instruction
L'Oréal, (contd.)

Sample (continued)



L'ORÉAL
TECHNICAL INFORMATION

volutis with volufix

CHOOSING THE SOLUTION

Choose the solution according to the type of hair your client has — when in doubt, choose one weaker —
Solution No. 1S — for resistant, hard to wave hair
Solution No. 1 — for normal hair
Solution No. 2 — for easy to wave hair
Solution No. 3 — for sensitized hair

WAVING WITH VOLUTIS

Shampoo.
Thoroughly towel dry (or alternatively dry under dryer).
Dampen and wind section by section. An average of fifty-five (55) to sixty (60) curlers will give best results.
Take two (2) or three (3) test curls in different parts of the head.
Re-saturate each wound curl.
Place processing cap over whole head.

PROCESSING

Check every 3-5 minutes.
Normal processing time 5-15 minutes.

RINSING

Rinse very thoroughly to remove all solution from wound curlers. With a towel or sea sponge blot excess water from the curlers.

NEUTRALISING WITH VOLUFIX

Use VOLUFIX only with VOLUTIS solutions.
Snip the top of the applicator and apply VOLUFIX to each side of wound curlers.
Repeat the operation until all VOLUFIX has been used.
Alternatively VOLUFIX can be applied with a small sponge.
Leave for 5 minutes. Remove curlers.
Then gradually massage VOLUFIX into the ends of the hair to ensure a good penetration.
Leave a few minutes. Finally rinse very thoroughly.

APPENDIX 'A'

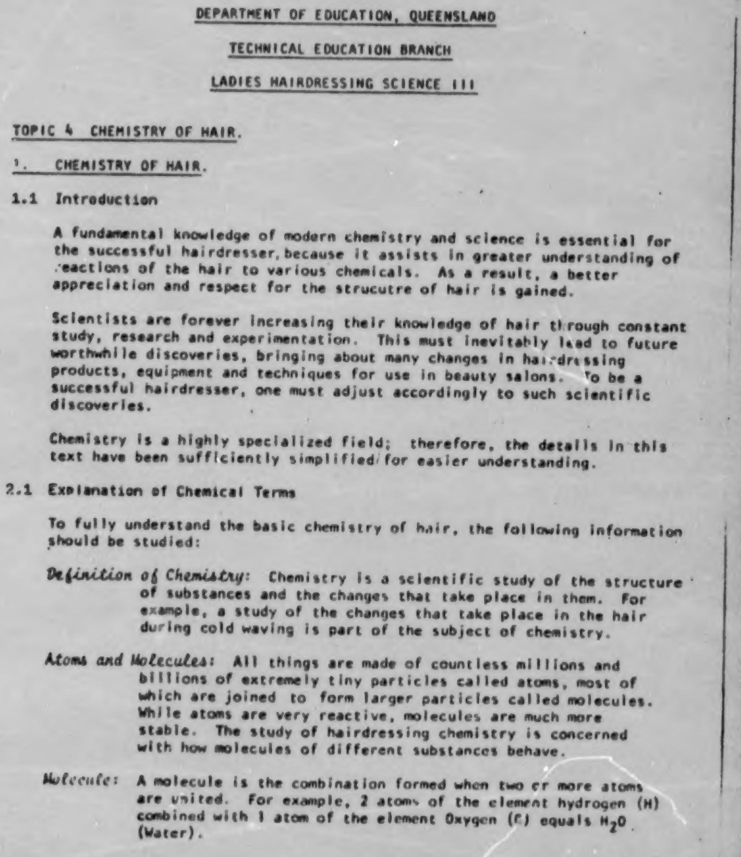
VII. HAIRDRESSING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document VII. (b)	Queensland Department of Technical and Further Education (T.A.F.E.) College. *Hairdressing Notes.*
Purpose	College Notes
Description	Theory, Procedural Directions
Readability Estimate	12.4

Sample



DEPARTMENT OF EDUCATION, QUEENSLAND

TECHNICAL EDUCATION BRANCH

LADIES HAIRDRESSING SCIENCE III

TOPIC 4 CHEMISTRY OF HAIR.

1. CHEMISTRY OF HAIR.

1.1 Introduction

A fundamental knowledge of modern chemistry and science is essential for the successful hairdresser, because it assists in greater understanding of reactions of the hair to various chemicals. As a result, a better appreciation and respect for the strucutre of hair is gained.

Scientists are forever increasing their knowledge of hair through constant study, research and experimentation. This must inevitably lead to future worthwhile discoveries, bringing about many changes in hairdressing products, equipment and techniques for use in beauty salons. To be a successful hairdresser, one must adjust accordingly to such scientific discoveries.

Chemistry is a highly specialized field; therefore, the details in this text have been sufficiently simplified for easier understanding.

2.1 Explanation of Chemical Terms

To fully understand the basic chemistry of hair, the following information should be studied:

Definition of Chemistry: Chemistry is a scientific study of the structure of substances and the changes that take place in them. For example, a study of the changes that take place in the hair during cold waving is part of the subject of chemistry.

Atoms and Molecules: All things are made of countless millions and billions of extremely tiny particles called atoms, most of which are joined to form larger particles called molecules. While atoms are very reactive, molecules are much more stable. The study of hairdressing chemistry is concerned with how molecules of different substances behave.

Molecule: A molecule is the combination formed when two or more atoms are united. For example, 2 atoms of the element hydrogen (H) combined with 1 atom of the element Oxygen (O) equals H_2O (Water).

VII. HAIRDRESSING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VII. (b)

Queensland Department of Technical and Further Education (T.A.F.E.) College. *Hairdressing Notes (contd.)*

Sample (continued)

LESSON 5 P. 3.

PURPOSE OF SUDORIFEROUS GLAND

The purpose of the SUDORIFEROUS gland is to produce sweat. This is a very necessary action, as it serves to rid the body of waste material and to keep the body cool.

Sweat is without colour and has a salty taste.

Sudoriferous glands are found all over the body but mainly on palms of hands, soles of feet, under arms and on the face.

The sweat gland is controlled by the nervous system.

The glands become very active when exercising, during hot weather and when excited or nervous.

THE BASIC TYPES OF NERVES OF THE SKIN

The nerve is a whitish cord, make up of bundles of fibres which carry messages from the area of nerve ending to the nervous system and back again.

Nerves are divided into three (3) classes.

1. MOTOR
2. SENSORY
3. SECRETORY

1. MOTOR NERVE.

This is the one that carries messages from the brain and spinal cord for the muscular contraction or expansion of blood vessels. That is the opening and closing that regulates the blood flow through the vein.

This motor nerve also regulates the contraction or tightening of the ARRECTOR-PILI muscles when we feel cold or get a fright.

This gives us goose-flesh and makes our hair stand on end. As the arrector-pili muscle contracts or shortens, it pulls the base of the hair follicle into an upright position in the scalp.

This is easily seen when you see that the hair follicle is positioned in the skin at a slight angle and the arrector-pili muscle is attached to the underside of the hair bulb and also to the EPIDERMIS this is why when the muscle contracts the hair follicle stands straight and the hair stands on end.

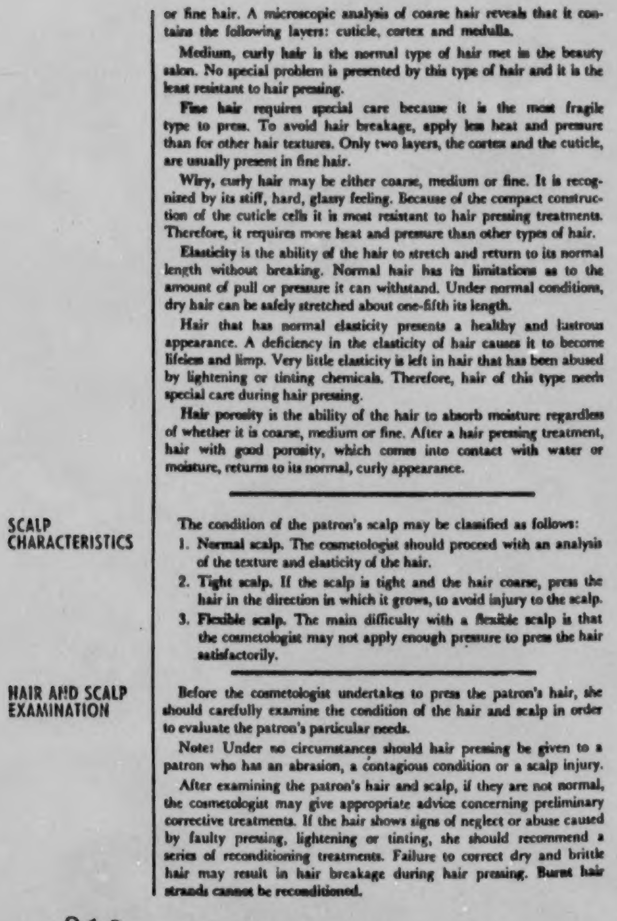
VII. HAIRDRESSING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VII. (c)	*The Van Dean Manual*, 1979 New York: Milady Co.
Purpose	College Text
Description	Theory, and Procedural Directions.
Readability Estimate	10.8

Sample



or fine hair. A microscopic analysis of coarse hair reveals that it contains the following layers: cuticle, cortex and medulla.

Medium, curly hair is the normal type of hair met in the beauty salon. No special problem is presented by this type of hair and it is the least resistant to hair pressing.

Fine hair requires special care because it is the most fragile type to press. To avoid hair breakage, apply less heat and pressure than for other hair textures. Only two layers, the cortex and the cuticle, are usually present in fine hair.

Wiry, curly hair may be either coarse, medium or fine. It is recognized by its stiff, hard, glassy feeling. Because of the compact construction of the cuticle cells it is most resistant to hair pressing treatments. Therefore, it requires more heat and pressure than other types of hair.

Elasticity is the ability of the hair to stretch and return to its normal length without breaking. Normal hair has its limitations as to the amount of pull or pressure it can withstand. Under normal conditions, dry hair can be safely stretched about one-fifth its length.

Hair that has normal elasticity presents a healthy and lustrous appearance. A deficiency in the elasticity of hair causes it to become lifeless and limp. Very little elasticity is left in hair that has been abused by lightening or tinting chemicals. Therefore, hair of this type needs special care during hair pressing.

Hair porosity is the ability of the hair to absorb moisture regardless of whether it is coarse, medium or fine. After a hair pressing treatment, hair with good porosity, which comes into contact with water or moisture, returns to its normal, curly appearance.

SCALP CHARACTERISTICS

The condition of the patron's scalp may be classified as follows:

1. **Normal scalp.** The cosmetologist should proceed with an analysis of the texture and elasticity of the hair.
2. **Tight scalp.** If the scalp is tight and the hair coarse, press the hair in the direction in which it grows, to avoid injury to the scalp.
3. **Flexible scalp.** The main difficulty with a flexible scalp is that the cosmetologist may not apply enough pressure to press the hair satisfactorily.

HAIR AND SCALP EXAMINATION

Before the cosmetologist undertakes to press the patron's hair, she should carefully examine the condition of the hair and scalp in order to evaluate the patron's particular needs.

Note: Under no circumstances should hair pressing be given to a patron who has an abrasion, a contagious condition or a scalp injury.

After examining the patron's hair and scalp, if they are not normal, the cosmetologist may give appropriate advice concerning preliminary corrective treatments. If the hair shows signs of neglect or abuse caused by faulty pressing, lightening or tinting, she should recommend a series of reconditioning treatments. Failure to correct dry and brittle hair may result in hair breakage during hair pressing. **Burnt hair strands cannot be reconditioned.**

APPENDIX 'A'

VII. HAIRDRESSING

LITERACY ON THE JOB

LIST OF READING MATERIALS

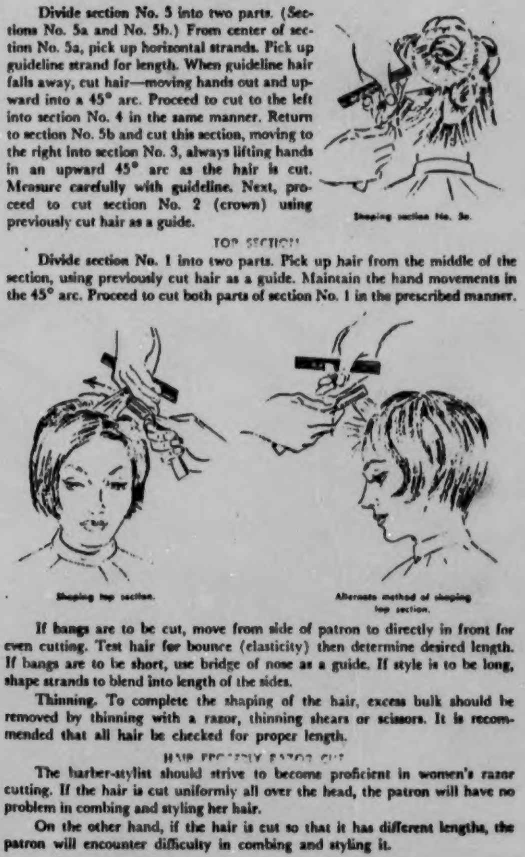
Document VII. (d) Barber Styling Text Book Committee, (1977). *Standard Text Book of Professional Barber Styling.* Bronx: Milady Publishing Co.

Purpose College Text

Description Theory and Procedural Directions

Readability Estimate 10.8

Sample



Divide section No. 5 into two parts. (Sections No. 5a and No. 5b.) From center of section No. 5a, pick up horizontal strands. Pick up guideline strand for length. When guideline hair falls away, cut hair—moving hands out and upward into a 45° arc. Proceed to cut to the left into section No. 4 in the same manner. Return to section No. 5b and cut this section, moving to the right into section No. 3, always lifting hands in an upward 45° arc as the hair is cut. Measure carefully with guideline. Next, proceed to cut section No. 2 (crown) using previously cut hair as a guide.

Shaping section No. 5a.

TOP SECTION

Divide section No. 1 into two parts. Pick up hair from the middle of the section, using previously cut hair as a guide. Maintain the hand movements in the 45° arc. Proceed to cut both parts of section No. 1 in the prescribed manner.

Shaping top section.

Alternate method of shaping top section.

If bangs are to be cut, move from side of patron to directly in front for even cutting. Test hair for bounce (elasticity) then determine desired length. If bangs are to be short, use bridge of nose as a guide. If style is to be long, shape strands to blend into length of the sides.

Thinning. To complete the shaping of the hair, excess bulk should be removed by thinning with a razor, thinning shears or scissors. It is recommended that all hair be checked for proper length.

HAIR PROPERLY RAZOR CUT

The barber-stylist should strive to become proficient in women's razor cutting. If the hair is cut uniformly all over the head, the patron will have no problem in combing and styling her hair.

On the other hand, if the hair is cut so that it has different lengths, the patron will encounter difficulty in combing and styling it.

APPENDIX 'A'

VIII. PLUMBING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VIII. (a)	Plumbing Plan
Document VIII. (b)	Sewerage & Water Supply Act Amendment *By-Laws.* *

LITERACY AT COLLEGE

Document VIII. (c)	Basic Trade Manual Plumbing & Water Supply *Sanitation Plumbing*

* *(Also Used at College)*

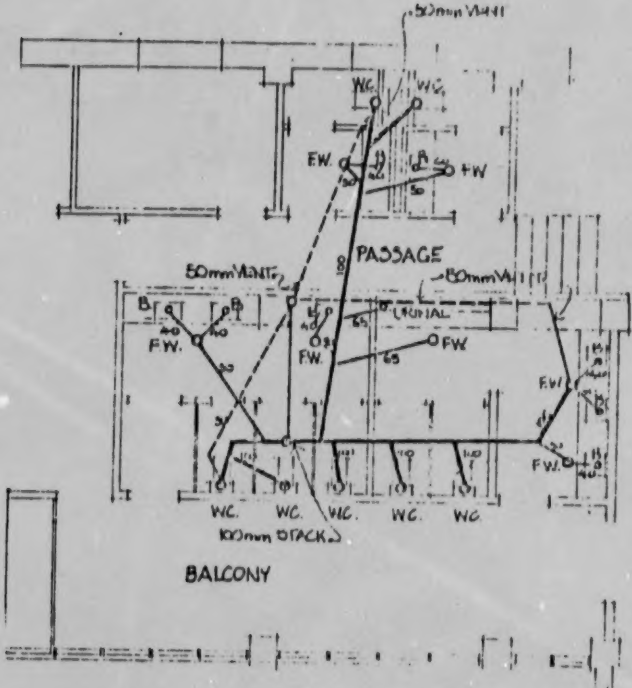
APPENDIX 'A'

VIII. PLUMBING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VIII. (a)	Plumbing Plan
Purpose	Detailed Job Instruction
Description	Technical Drawing
Readability Estimate	N/a
Sample	



APPENDIX 'A'

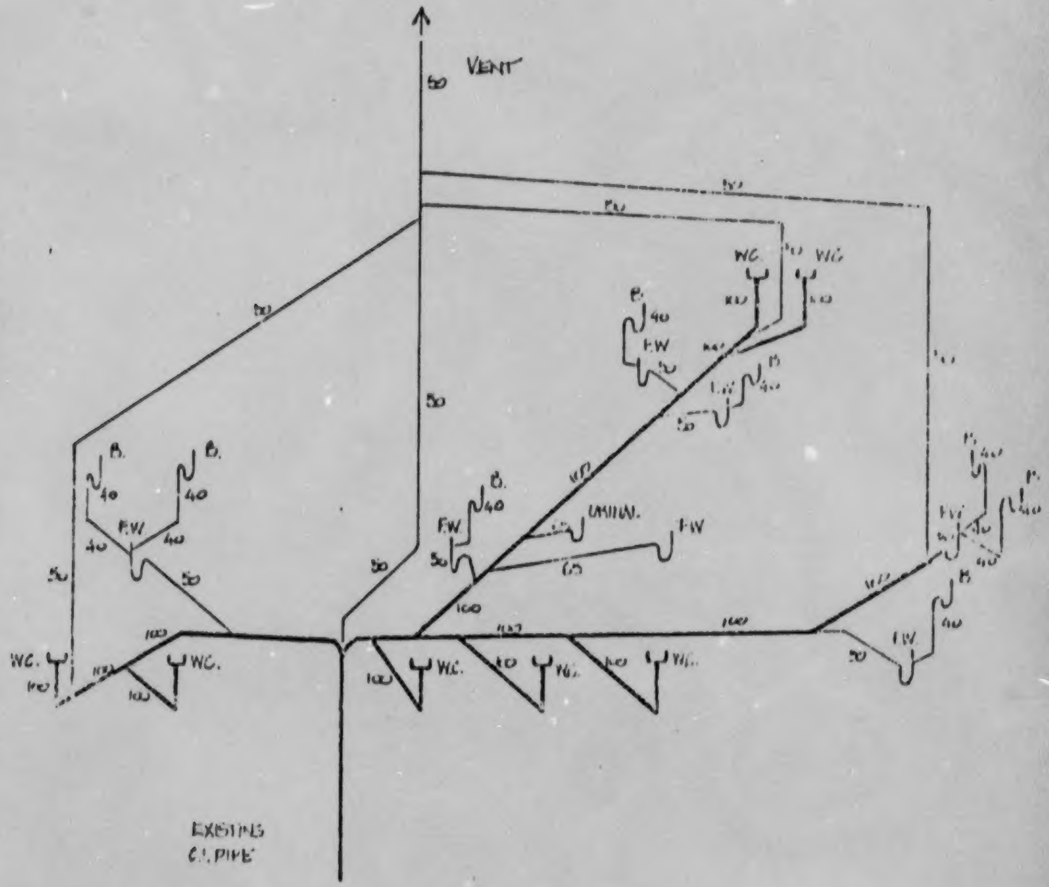
VIII. PLUMBING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document VIII. (a) Plumbing Plan (continued)

(continued)



APPENDIX 'A'

VIII. PLUMBING

LITERACY ON THE JOB (ALSO AT COLLEGE)

LIST OF READING MATERIALS

Document VIII. (b)	Sewerage and Water Supply Act Amendment Bill *By-Law*
Purpose	Detailed Job Instruction Updating knowledge
Description	Standards and Specifications
Readability Estimate	12.2
Sample	

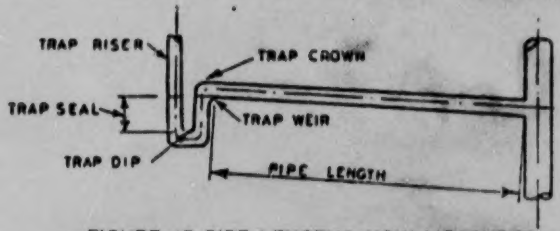


FIGURE 17 PIPE LENGTHS HOW MEASURED

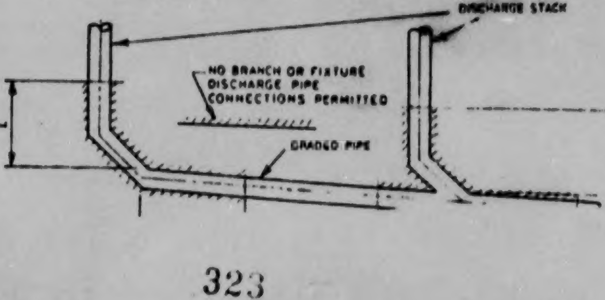
107. Connection of Branches and Fixture Discharge Pipes near **the base of Discharge Stacks.** (1) Branches and fixture discharge pipes shall not be connected to the graded pipe within 2·5 m downstream or 1 m upstream from a discharge stack entry point.

(2) Branches and fixture discharge pipes shall not be connected to the discharge stack within the following distances from the base of the stack:—

(a) for stacks not more than five storeys in height, at least 600 mm between the base of the stack and the invert of the lowest branch or fixture discharge pipe;

(b) for stacks more than five storeys in height, at least 1 m between the base of the stack and the invert of the lowest branch or fixture discharge pipe.

(3) The distances prescribed in (a) and (b) of clause (2) shall be increased as required by the engineer to avoid foaming in soft water areas.



VIII. PLUMBING

LITERACY ON THE JOB (ALSO AT COLLEGE)

LIST OF READING MATERIALS

Document VIII. (b) — Sewerage and Water Supply Act
(continued) — Amendment Bill
By-Law

Sample (continued)

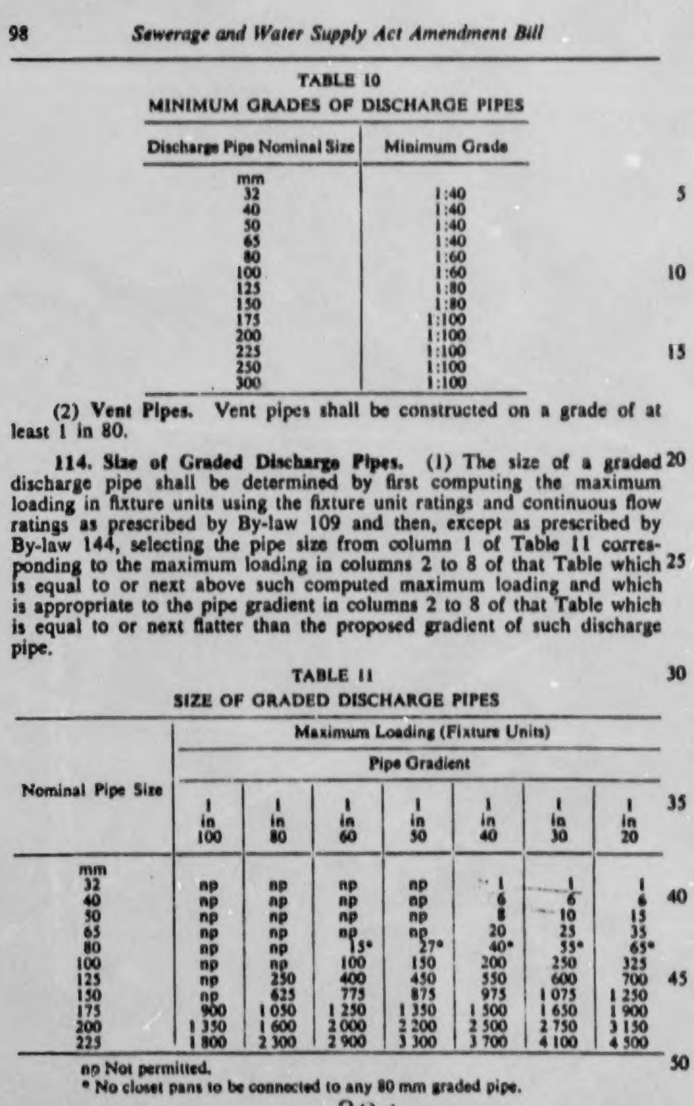


TABLE 10
MINIMUM GRADES OF DISCHARGE PIPES

Discharge Pipe Nominal Size	Minimum Grade
mm	
32	1:40
40	1:40
50	1:40
65	1:40
80	1:60
100	1:60
125	1:80
150	1:80
175	1:100
200	1:100
225	1:100
250	1:100
300	1:100

(2) **Vent Pipes.** Vent pipes shall be constructed on a grade of at least 1 in 80.

114. Size of Graded Discharge Pipes. (1) The size of a graded discharge pipe shall be determined by first computing the maximum loading in fixture units using the fixture unit ratings and continuous flow ratings as prescribed by By-law 109 and then, except as prescribed by By-law 144, selecting the pipe size from column 1 of Table 11 corresponding to the maximum loading in columns 2 to 8 of that Table which is equal to or next above such computed maximum loading and which is appropriate to the pipe gradient in columns 2 to 8 of that Table which is equal to or next flatter than the proposed gradient of such discharge pipe.

TABLE 11
SIZE OF GRADED DISCHARGE PIPES

Nominal Pipe Size	Maximum Loading (Fixture Units)						
	Pipe Gradient						
	1 in 100	1 in 80	1 in 60	1 in 50	1 in 40	1 in 30	1 in 20
mm							
32	np	np	np	np	1	1	1
40	np	np	np	np	6	6	6
50	np	np	np	np	8	10	15
65	np	np	np	np	20	25	35
80	np	np	15*	27*	40*	55*	65*
100	np	np	100	150	200	250	325
125	np	250	400	450	550	600	700
150	np	625	775	875	975	1 075	1 250
175	900	1 050	1 250	1 350	1 500	1 650	1 900
200	1 350	1 600	2 000	2 200	2 500	2 750	3 150
225	1 800	2 300	2 900	3 300	3 700	4 100	4 500

np Not permitted.
* No closet pans to be connected to any 80 mm graded pipe.

VIII. PLUMBING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document VIII (c)	Basic Trade Manual Plumbing and Water Supply *Sanitation Plumbing*
Purpose	College Text
Description	Theory, Procedural Instructions
Readability Estimate	11.3
Sample	

FAULTS AND REMEDIES FOR FLOAT VALVES

DEFECT	CAUSE	REMEDY
Water overflow from cistern or tank.	Rubber washer in plunger worn or defective.	Renew washer.
	Foreign matter lodged between seat and washer, or plunger jammed in valve body.	Remove plunger. Clean and inspect for burrs. Inspect seat and clean. Inspect washer and renew if damaged.
	Float waterlogged due to puncture or crack. Float remains submerged and keeps valve open.	Drain float, repair or renew. Repair by soldering if made of copper or brass; by solvent cement if plastic.
	Float fouling some part of cistern or mechanism	Free float and adjust arm as necessary.
	Float lever arm incorrectly adjusted.	Lower waterlevel by bending lever downward at float end. This will force the rubber washer against valve seat earlier.
	Excessive wear in lever arm pin, pinhole or between plunger and lever arm.	Replace worn components or complete assembly as necessary.
	Valve seat damaged, not providing proper seating surface for washer.	Reface seat or replace valve assembly.

VIII. PLUMBING

LITERACY AT COLLEGE

LIST OF READING MATERIALS

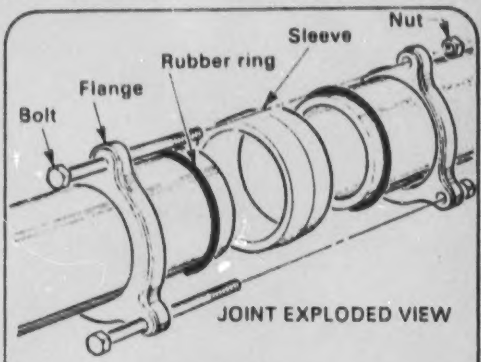
Document VIII.(c) (continued)

Basic Trade Manual Plumbing and Water Supply

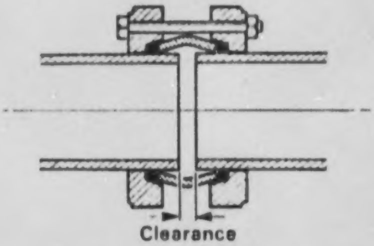
Sanitation Plumbing

The Gibault Joint

This joint can be used to join two plain pipe ends together, repair longitudinal fractures in pipes or for the installation of plain-ended fittings which may have to be removed for maintenance purposes such as valves.



JOINT EXPLODED VIEW



CROSS SECTION-ASSEMBLED JOINT

THE GIBAULT JOINT

The Gibault joint consists of:

- A sleeve (usually cast iron)
- Two flanges (cast iron)
- Two rubber rings
- The necessary nuts and bolts.

To make a Gibault joint:

- Place a flange and a rubber ring on each end of the pipes to be joined, as shown
- Slide the sleeve over the end of one pipe
- Move the other pipe or fitting into the free sleeve end, leaving about 6 mm clearance between pipe ends for expansion
- Adjust the sleeve centrally over the pipe ends
- Draw the flanges and rubber rings up to the sleeve
- Insert the bolts and nuts, then gradually and evenly tighten the nuts so compressing the rubber rings against the cast iron sleeve and pipe spigot to make a watertight joint.

Repairing a Longitudinal Fracture

Where a break is too long to be repaired by a DNR joint (see below for radial fractures), repairs can be carried out as follows:

- Using the appropriate cutting tools, cut out the damaged section of pipe at 75 mm beyond the ends of the fracture
- Cut a suitable length of replacement pipe, making allowance for clearances, and remove sharp edges
- Assemble the appropriate size Gibault joint over each cut.

IX. BOILERMAKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IX. (a)	*Australian Standard 25, Part 1, 1968*
Document IX. (b)	Detail of Technical Drawing

LITERACY AT COLLEGE

Document IX. (c)	Queensland Department of Education, T.A.F.E. Branch. *Boilermaking, First Year Theory.*

APPENDIX 'A'

IX. BOILERMAKING

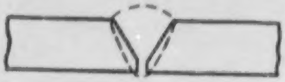
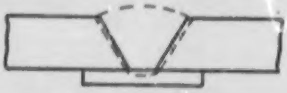
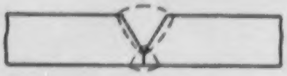
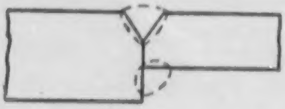
LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IX. (a)	*Australian Standard 25, Part 1, 1968*
Purpose	Detailed Job Instruction
Description	Standards and Specifications
Readability Estimate	10.6

Sample

TYPICAL WELDING PREPARATIONS

Fig. No.	Sketch	Type of joint	Type of weld(s)	Preparation	Remarks
3152A		Butt	Butt	Single-V with root faces	Full penetration
3152B		Butt	Butt	Single-V with backing strip	Full penetration
3152C		Butt	Butt	Single-V with root faces	Full penetration. Sealing run used
3152D		Butt	Butt and fillet	Single-V with wide or deep root faces	Partial penetration Welded from bo sides

APPENDIX 'A'

IX. BOILERMAKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IX. (a)

(continued)

Sample (continued)

Australian Standard 25, Part 1, 1968.

SECTION 4—TERMS RELATING TO BRAZE WELDING, BRAZING AND SOLDERING

SUBSECTION 41—TERMS RELATING TO BOTH BRAZING PROCESSES

No.	Term	Definition
4101	**stopping-off agent**	Lamp black, graphite or similar material placed on a work piece around the joint to prevent molten filler metal from adhering to adjacent surfaces.
4102	**bell joint**	A joint between two tubes of the same diameter, one tube end being swaged out to receive the end of the other tube.

SUBSECTION 42—TERMS RELATING ONLY TO BRAZE WELDING

No.	Term	Definition
4201	**braze welding**	The joining of metals using a technique similar to fusion welding and a filler metal with a lower melting point than the parent metal, but neither using capillary action as in brazing nor intentionally melting the parent metal.
4202	**bronze welding**	A form of braze welding in which copper-rich filler metal is used.
4203	**gas fluxing**	A method of supplying a flux in gas form to the joint during braze welding. The flux, originally liquid, is generally entrained by the fuel gas from a dispenser and passes through the flame to the joint.
4204	**bronze filler metal** BRONZE WELDING ROD	Filler metal used for bronze welding, consisting basically of copper and zinc. It may also contain nickel, manganese or other metals. NOTE: The term "bronze" is not used here in the ordinary metallurgical sense.
4205	**diminishing bell joint**	A joint between two pipes of different diameters, in which the end of the smaller pipe is swaged out to fit the bore of the larger pipe (see Fig. 4205).

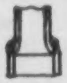


Fig. 4205. DIMINISHING BELL JOINT

No.	Term	Definition
4206	**branch T saddle joint**	A joint between a branch pipe and a main pipe set at 90° to each other, the end of the branch pipe being shaped to fit snugly against the main pipe.

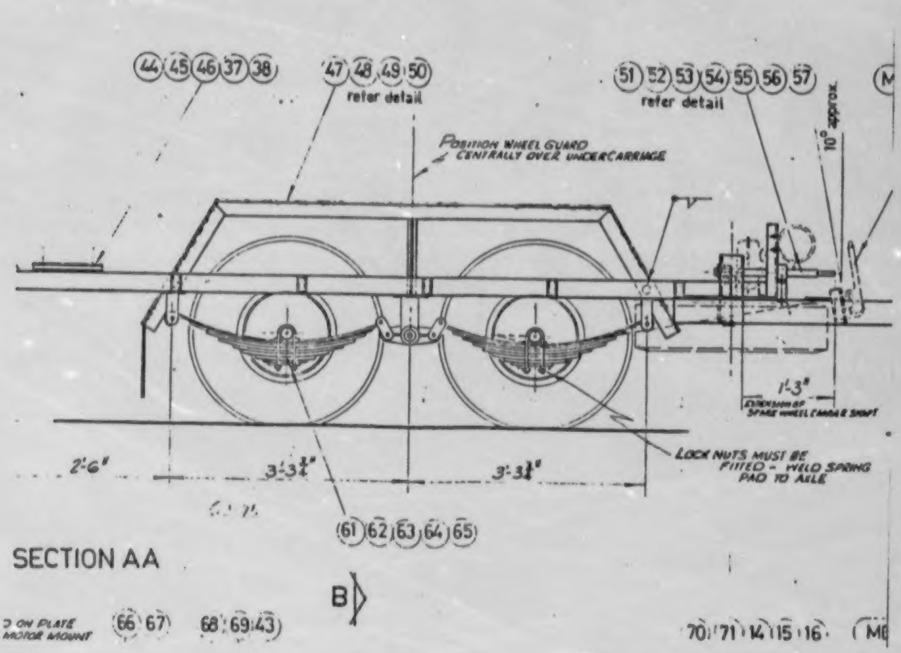
APPENDIX 'A'

IX. BOILERMAKING

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document IX. (b)	Detail of Technical Drawing
Purpose	Detailed Job Description
Description	Technical Drawing
Readability Estimate	N/a
Sample	



APPENDIX 'A'

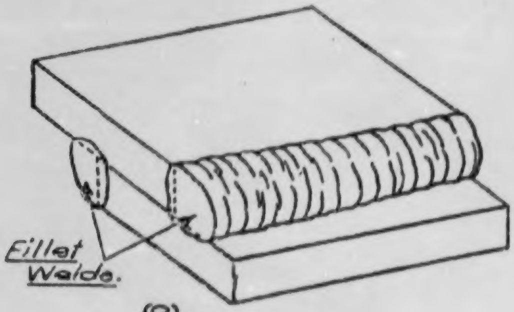
IX. BOILERMAKING

LITERACY AT COLLEGE

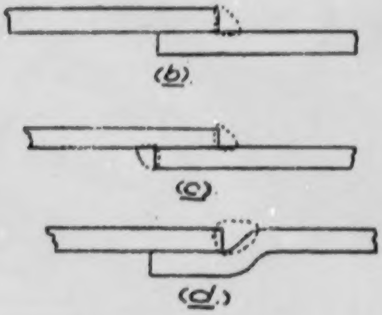
Document IX. (c)	Queensland Department of Education, T.A.F.E. Branch. *Boilermaking, First Year Theory*
Purpose	College Text
Description	Theory
Readability Estimate	10.8
Sample	

LAP JOINT.

This type of joint is used to join two overlapping plates, so that the edge of each plate is welded to the surface of the other. See Fig. 23 (a) and (c).



Lap Joint.



Types of lap joints in sheetmetal

IX. **BOILERMAKING**

LITERACY AT COLLEGE

Document IX. (c)
(continued)

Queensland Department of Education,
T.A.F.E. Branch.
Boilermaking, First Year Theory.

Sample (continued)

BOILERMAKING

FIRST YEAR

46

TRADE THEORY - PART I

SECTION 3

ELECTRIC WELDING

The two types of welding to be considered in the following chapters will be the electric arc and resistance welding.

ARC WELDING.

Arc welding is a fusion process in which a welding rod is cast into the previously fused spaced between the metals to be joined. The required heat, which melts the parent metal and the filler rod, is obtained from the electric arc which is struck between the electrode and the work piece, a temperature of 3 500° to 4 000° C being obtained near the crater of the arc.

RESISTANCE WELDING.

When a sufficiently heavy current flows through a high resistance, intense heating takes place. In resistance welding, two electrodes or two clamps, are incorporated in a circuit of low resistance and the metals to be welded are pressed between the electrodes or held in the clamps and pressed together.

The circuit is thus completed and the electrical resistance at the joint of the metals to be welded is so high, in comparison with the rest of the circuit, that if the current is heavy enough the joint of the metals is heated to the plastic state necessary for welding to take place.

The pieces are then given additional pressure to force them together and the weld is completed. The energy used in making a resistance weld is therefore partly electrical and partly mechanical.

Variations of resistance welding are spot welding, seam welding, plain butt weld and flash butt weld.

SPOT WELDING.

Spot welding is the most widely used of the resistance welding processes. Fig. 1 shows how heat is applied through a pair of arms and points (electrode) and pressure through the moving top arm to weld the work in a spot which is varied in size according to the thickness of the pieces to be welded.

APPENDIX 'A'

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document X. (a)	Bakke, J. 1968. Caterpillar Tractor Co. *An Introduction to Fasteners*
Document X. (b)	Caterpillar Service Magazine, May 25, 1981.

LITERACY AT COLLEGE

Document X. (c)	Queensland Department of T.A.F.E. *Fitter (Diesel and Heavy Earthmoving Equipment) - Third Year Notes*
Document X. (d)	Mount Gravatt College of T.A.F.E. *Fitting Diesel and Heavy Earthmoving Equipment Notes.*
Document X. (e)	John Deere Electrical Systems *Fundamentals of Service*
Document X. (f)	Asurus, A.F. 1979. *Diesel Engines and Fuel Systems.* Pitman, Australia.

APPENDIX 'A'

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

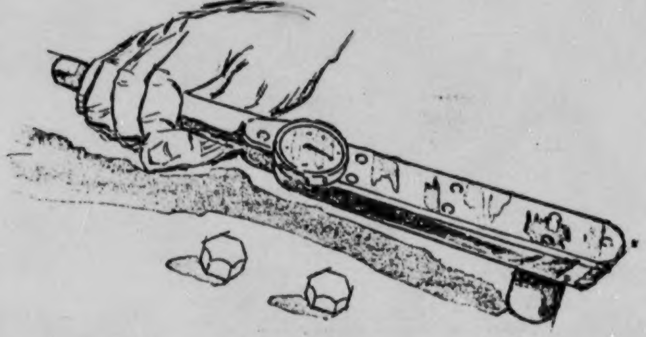
LITERACY ON THE JOB

LIST OF READING MATERIALS

Document X. (a)	Bakke, J. 1968 Caterpillar Tractor Co. *An Introduction to Fasteners*
Purpose	Text
Description	Procedural Directions
Readability Estimate	9.8
Sample	

TORQUE WRENCHES

When a bolt or nut is just about *wrench tight* a TORQUE WRENCH can be substituted for the ratchet handle. With the torque wrench attached to the socket, a dial indicator indicates torque in *foot pounds* or *inch pounds.*



General torque values for various sizes of bolts are published in the Caterpillar Service Manual; these values are based on *dry threads*—ones to which no lubricant has been applied. However, there are some exceptions, so check the recommendations carefully—some torque values are based on *lubricated* threads.

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

LITERACY ON THE JOB

LIST OF READING MATERIALS

Document X. (b)	Caterpillar Service Magazine, May 25, 1981
Purpose	Updating Information
Description	Procedural Directions
Readability Estimate	15.0
Sample	

Different Mounting Hardware Used In Rollover Protective System Group, Mirror Group And Cover Group

7325, 7319, 7329

943 And 953 Loaders

DESCRIPTION OF CHANGE: Different mounting hardware is used in the rollover protective system group, the rear view mirror group and the miscellaneous cover group on 943 and 953 Loaders. The hardware formerly used to hold the headliner, the lighting group and the mirrors did not have protection against rust caused by surface moisture (water). The rust made the machines look bad in some areas and made adjustment of the mirrors difficult. The new mounting hardware used in these locations has protection against rust.

ADAPTABLE AS: A direct replacement as shown in the chart.

Quan.	New Part No.	Description	Former Part No.
7P78[illegible] Rollover Group - Protective			
4	5M30[illegible]	Bolt	S509
7P[illegible]7 Mirror Group - Rear View			
6	5M3062	Bolt	5S7379
2	8L7395	Nut	1D4717
7P6502 Cover Group - Miscellaneous			
6	5M3062	Bolt	S509

■

APPENDIX 'A'

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document X. (c)	Queensland Department of T.A.F.E. *Fitter (Diesel and Heavy Earthmoving Equipment) - Third Year Notes*
Purpose	College Notes
Description	Theory
Readability	12.6
Sample	

The line diagram, Fig. 9.3 illustrates a two stage compressor with a water cooled intercooler to remove heat from the low pressure air before it is delivered to the high pressure cylinder. The hot compressed air from the high pressure cylinder is now cooled by passing through the water cooled aftercooler before it passes to reservoir.

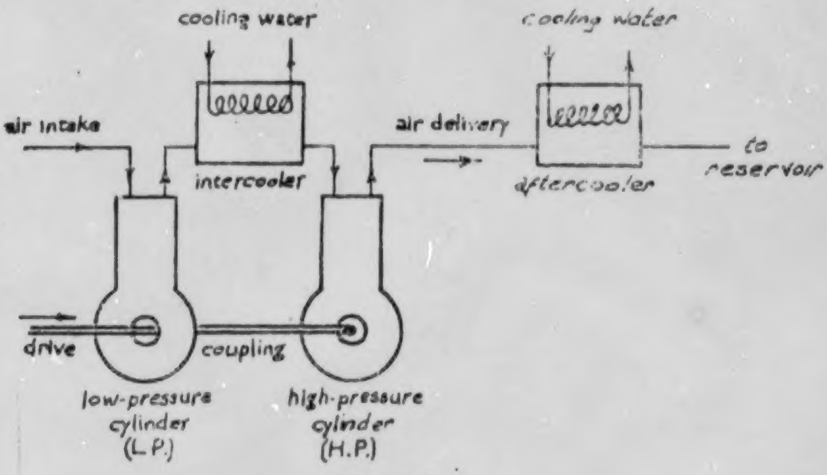


Fig. 9.3

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document X. (d)	Mount Gravatt College of T.A.F.E. *Fitting Diesel and Heavy Earthmoving Equipment Notes.*
Purpose	College Notes
Description	Theory
Readability Estimate	11.0
Sample	

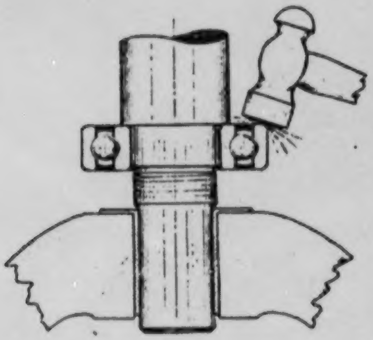


Fig. 4.5

Never, under any circumstances, use a hammer on the outer ring of a bearing that is fitted to a shaft by the inner ring. The bearing will be ruined, the shaft will be bruised, and threads will be burred. Fig. 4.5.

Remember - pressure must only be applied to the bearing ring that is tight - either on shaft or in housing.

A puller is the best tool for removing a ball bearing or an outer ring of a roller bearing from a housing, and again the removing force must only be applied to the tight outer ring.

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document X. (d)
(continued)

Mount Gravatt College of T.A.F.E.
Fitting Diesel and Heavy Earthmoving Equipment Notes.

Sample (continued)

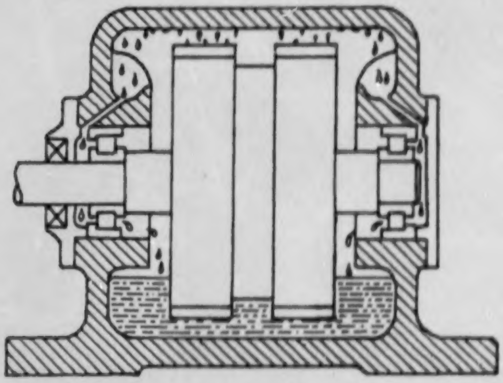
5.7. LUBRICATION SYSTEMS.

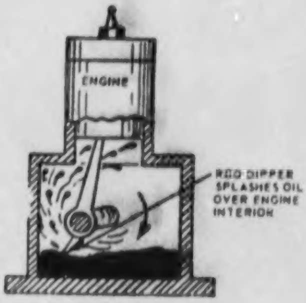
Oil Lubrication. Oil lubrication is desirable with high operating speeds, subnormal or abnormal temperatures, and for installations where other machine components close or adjacent to the bearing, such as gears, are to be oil lubricated.

5.8. Splash Feed. This system is suitable where bearings are enclosed in a casing, such as a gear-box or final drive, and the oil used to lubricate the gears is distributed sufficiently to lubricate the bearings.

The oil is either splashed directly onto the bearings or collected in galleries and led to the bearings, as in Fig. 5.2(a)

SPLASH Lubrication is also used in older engines and even smaller one cylinder modern engines to lubricate the bearings, cylinder wall, camshaft, timing gears etc. as shown in Fig. 5.2(b)





Simple splash oiling system.

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document X. (e)	John Deere Electrical Systems *Fundamentals of Service*
Purpose	Text
Description	Theory
Readability Estimate	10.0
Sample	

4—22 Charging Circuits

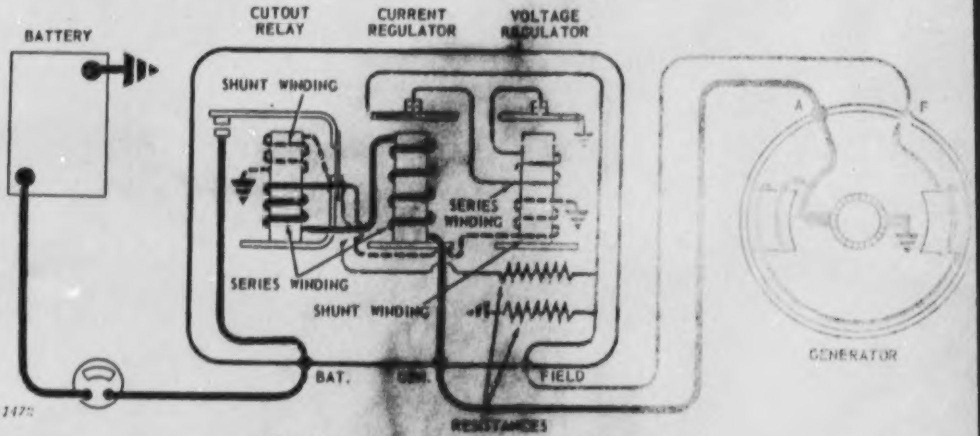


Fig. 47—Voltage Regulator with Accelerator Winding

The same speed causes the series coil magnetic field to collapse faster. When the armature point is suddenly released, it closes the circuit with the stationary point. The cycle is again repeated at a fast rate.

Voltage regulated in this manner allows the generator to supply varying amounts of current as needed by the battery and load circuits.

field is directly connected to ground. The output again increases and the cycle is repeated as long as there is a heavy load.

As soon as the load is reduced (the battery is fully charged or the accessories are turned off) the voltage will increase. The *voltage* regulator then operates and gradually reduces the output. With the voltage regulator operating, there is no

APPENDIX 'A'

X. FITTER (DIESEL AND HEAVY EARTHMOVING)

LITERACY AT COLLEGE

LIST OF READING MATERIALS

Document X. (f)	Asurus, A.F. 1979. *Diesel Engines and Fuel Systems* Pitman, Australia.
Purpose	Text
Description	Theory
Readability Estimate	9.9
Sample	

Robert Bosch EP/RSV mechanical governor

Robert Bosch GmbH manufacture a mechanical variable speed governor, type EP/RSV. Distinctive features of the EP/RSV governors, apart from their compactness, are the simplicity with which their governing range and speed droop can be altered by means of adjusting screws, the automatic setting of the excess fuel quantity required for starting, and adjustment of the maximum fuel delivery to the needs of the engine at any speed.

The governor is fitted in its housing on the injection pump, its rotating parts such as the carrier and flyweights being fixed to the pump camshaft. The two flyweights pivot on pins in the carrier, and press the rollers or sliding jaws at the ends of their bell cranks against the shoulder of the thrust sleeve when they are flung outwards.

The thrust sleeve moves back or forth along the hub of the carrier and rotates with it. The plain or ball bearing incorporated in the thrust sleeve connects it with a link which does not rotate, but which moves back and forth along the projected axis of the camshaft. The link connects to the long two-piece guide lever suspended on a pin in the governor cover, and therefore cannot twist with the thrust sleeve.

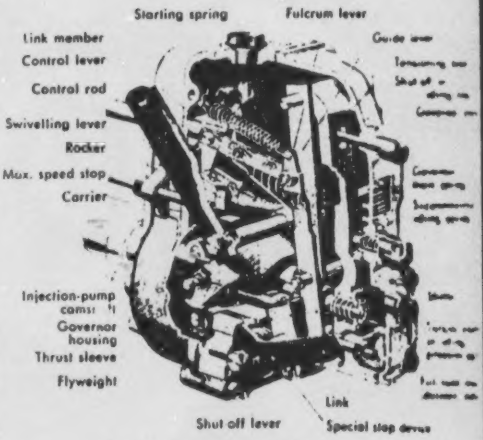


Fig 19.11 Bosch EP/RSV governor
(Courtesy: Robert Bosch GmbH)

The swivelling lever is fitted to a shaft, the ends of which pass through the governor cover. The control lever may be fitted to either end of this shaft.

If the control lever is moved from the shut-off position in the direction of start, the governor spring [illegible]

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

WRITING ON THE JOB

The following forms had to be completed by Diesel Fitters who were interviewed:

Workshop Reports:

(a) Mechanical Condition - Compressors,
- Tractors, Dozers, Loaders,
- Engines
- Graders.

(b) Inspection Report for Sale of Vehicles.

APPENDIX 'A'

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

WRITING ON THE JOB

Sample — Workshop Report - Compressors

WORKSHOP REPORT

Mechanical Condition

COMPRESSORS

DATE / / MFG. NO. M. .... M.R.D. .... MAKE & MODEL ....

Engine	
Radiator	
Air Cleaner	
Fuel Tank & Lines	
Electrical System	
Clutch	
Compressor	
Brakes	
Axle & Bearings Front	
Axle & Bearings Rear	
Wheels/Tyres	
Air Flow Test	
Controls	
Main Frame	
Body	
Drawbar Assembly	
Bolts	
Book Box	
Safety Equipment	
Paintwork	

APPROXIMATE NUMBER OF HOURS ....

APPENDIX 'A'

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

WRITING ON THE JOB

Sample

Workshop Report - Tractors
Dozers
Loaders

WORKSHOP REPORT

Mechanical Condition

TRACTORS
DOZERS
LOADERS

DATE / / MFG. NO. M. .... M.W.D. .... MODEL & MAKE ....

Engine	
Starting Engine	
Air Cleaner	
Radiator	
Fuel Tank & Lines	
Electrical System	
Master Clutch	
Slewing Clutch	
Slewing Brake	
Torque Converter	
Gear box	
Transmission	
Final Drive	
Steering Assembly	
Outrigger Bearings	
Sprockets/Wheels	
Track Frames/Axle Assy.	
Tracks/Tyres	
Track Rollers	
Carrier Rollers	
Front Idlers	
Front Idler Adj.	
P.C.U.	
Hydraulic System	

APPENDIX 'A'

X. FITTER (DIESEL AND HEAVY EARTH MOVING)

WRITING ON THE JOB

Sample   Workshop Report - Engines

WORKSHOP REPORT

ON MECHANICAL CONDITION OF ENGINES

DATE.../.../... M. NO.........M.R.D. NO..........MAKE AND MODEL..................

OIL PRESSURE	
EXHAUST EMISSION (COLOUR)	
LEAKS FUEL OIL WATER	
NOISE	
CRANKCASE BLOW BY	
CRANKSHAFT END FLOAT	
RADIATOR CONDITION	
RADIATOR WATER POLLUTION	
CRANKCASE OIL POLLUTION	
CHARGING SYSTEM	
STARTING SYSTEM	
ACCESSORIES	
STARTING	
EXHAUST LEAKS	
AIR CLEANER	
WATER PUMP	
OIL FILTERS	
FUEL FILTERS	
FUEL SYSTEM	

APPENDIX 'A'

X. FITTING (DIESEL AND HEAVY EARTH MOVING)

WRITING ON THE JOB

Sample — Workshop Report - Graders

WORKSHOP REPORT

on Mechanical Condition — GRADERS

DATE: / / MFG. NO. M .... M.R.D. .... MAKE & MODEL ....

Main Engine	
Starting Engine	
Electrical	
Radiator	
Engine Covers	
Bendix	
Clutch	
Gearbox	
Transmission	
Brakes	
Axle - Rear	
Wheels - Rear	
Tyres - Rear	
Tandem	
Axle - Front	
Wheels - Front	
Tyres - Front	
Steering Box	
Main Frame	
King Pins	
Controls	
Track Rod	
Control Box	
Take-off Shaft	
Tyne Box and Arms	
Tyne Block and Tynes	
Blade Circle Box	
"A" Frame	
Blade Shift, Box and Arms	
Leaning Wheel Box	
Canopy and Cover	
Windscreen	
Side Curtains	
Seat and Back Seat	
Side Arm Rest	
Tyre Compressor	
Book Box and Safety Signs	
Mouldboard	
Cutting Edges and Corners	

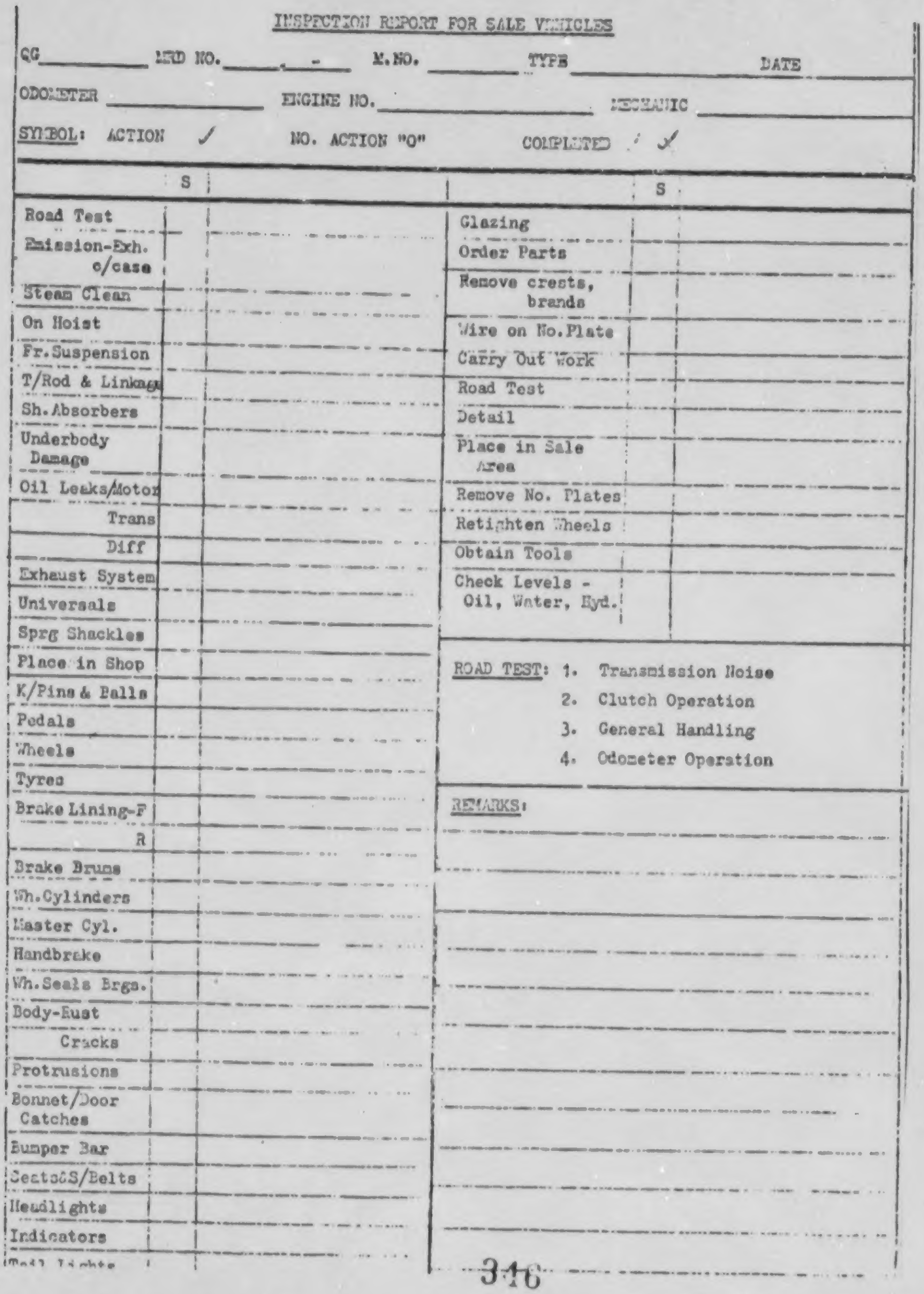
APPENDIX 'A'

X. FITTING (DIESEL AND HEAVY EARTH MOVING)

WRITING ON THE JOB

Sample

Inspection Report for Sale of Vehicles



INSPECTION REPORT FOR SALE VEHICLES

QG__________ MRD NO.______-____ M.NO. __________ TYPE __________________ DATE __________

ODOMETER ______________ ENGINE NO.____________________ MECHANIC ______________

SYMBOL: ACTION ✓ NO. ACTION "O" COMPLETED ✓

	S	
Road Test		
Emission-Exh. c/case		
Steam Clean		
On Hoist		
Fr.Suspension		
T/Rod & Linkage		
Sh.Absorbers		
Underbody Damage		
Oil Leaks/Motor		
Trans		
Diff		
Exhaust System		
Universals		
Sprg Shackles		
Place in Shop		
K/Pins & Balls		
Pedals		
Wheels		
Tyres		
Brake Lining-F		
R		
Brake Drums		
Wh.Cylinders		
Master Cyl.		
Handbrake		
Wh.Seals Brgs.		
Body-Rust		
Cracks		
Protrusions		
Bonnet/Door Catches		
Bumper Bar		
Seats&S/Belts		
Headlights		
Indicators		
Tail Lights		

	S	
Glazing		
Order Parts		
Remove crests, brands		
Wire on No.Plate		
Carry Out Work		
Road Test		
Detail		
Place in Sale Area		
Remove No. Plates		
Retighten Wheels		
Obtain Tools		
Check Levels - Oil, Water, Hyd.		

ROAD TEST:
1. Transmission Noise
2. Clutch Operation
3. General Handling
4. Odometer Operation

REMARKS:

APPENDIX 'B'

QUESTIONNAIRES.

EMPLOYER/SUPERVISOR QUESTIONNAIRE

1. What is the name of your business? ________________________

____

☐ 2. Its address and phone number ________________________

____
(surburban, city, country)

☐ 3. What is your position in the company? ________________________

____
(supervisor or employer or both?)

If employer,

☐ 4. How many staff do you employ? ________________________

____

☐ 5. How many apprentices would you have in each year in the various trades?

________________________ ________________________

________________________ ________________________

________________________ ________________________

I'd now like to ask you some general questions about the kind of reading the tradesman performs on the job? *

6. When the ________________________ (name trade) carries out his/her job what reading does he/she need to do?

____

____

____

____

____

* Is this the same for the first year apprentice?

6a. How is the ________________________ (name trade) told what job he/she has to carry out? (Does he receive verbal or written instructions?) *

☐ Verbal

☐ Written

6b. If written instructions are usually provided:
How often would he/she read them? *

☐ Daily

☐ If daily, how often

☐ 2-3 times per week

☐ Weekly

☐ Monthly

6c. How important is it to read them? (Prompt 2) *

☐ Vital

☐ Necessary

☐ Supplementary

(Collect sample)

6d. If necessary are detailed written instructions available to which the tradesman may refer in order to complete the job? *

☐ Yes

☐ No

* Is this the same for the first year apprentice?

☒ tradesman only

☒ tradesman and apprentice.

6e. If detailed instructions are available -

What form are they in? **

How often would the tradesman/woman be required to read them? **

How important is the reading of such material? (Prompt 2) **

		FREQUENCY					HOW IMPORTANT	
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Useful
Trade Manuals								
Textbooks								
Journal articles								
Manufacturer's Instructions*								
Microfiche								
Video								
Other:								

6f. When a problem arises on the job are any reference materials available to which the tradesman/woman may refer to for help and advice?

---

* e.g. package instructions, leaflets, booklets.

** Is this the same for the first year apprentice?

☐ tradesman only

☒ tradesman and apprentice

6g. How does the ________________ (name trade) locate this information?

Is this the same for the first year apprentice? ________________

6h. How does he/she use the reference material once he/she has found it?

Is this the same for the first year apprentice? ________________

7. How does the tradesman/woman update his knowledge on the latest developments in the trade?

(Prompt: What about reading for example, trade journals?)

Is this the same for the first year apprentice?

7a. If reading, what kind?

		FREQUENCY					HOW IMPORTANT	
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly		
Trade Journals								
Books								
Articles								
Manuals								
Other:								

☐ tradesman only
☒ tradesman + apprentice

8. When the ______________________________ (name trade) meets with customers is reading involved? *

8a. Does the tradesman/woman interpret written information to customers to help in product selection?

How often would he/she be required to do this?

How important is this to the completion of the task? *

(Fill in table at end of question. Prompt 2 if necessary.)

8b. Does the ______________________________ (name trade) interpret illustrations (pictorial representation, usually photographic) to customers to help in product selection?

How often would he/she be required to do this?

How important is this to the completion of the task? *

(Fill in table at end of question.)

8c. Does the ______________________________ (name trade) interpret diagrams (line drawings) to customers to help in product selection?

How often would he/she be required to do this?

How important is this to the completion of the task? *

(Fill in table at end of question.)

		FREQUENCY					HOW IMPORTANT	
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	VITAL	USEFUL
8a. Product Selection								
8b. Illustrations								
8c. Diagrams								

* Is this the same for the first year apprentice?

☒ tradesman only

☒ tradesman and apprentice

9. I am now going to ask you some questions about the kinds of arithmetic this trade requires of the tradesman/woman.

How often would the tradesman/woman be required to perform

____?

How important is the performance of ____________________?
(Prompt 2.)

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplement-ary
Mental Arithmetic									
Four Arithmetical Operations									
Metrification									
Length									
Area									
Volume									
Weight									
Angles									
Fractions									
Decimals									
Use of calculator									
Use of slide rule									
Use of tables									
Percentages									
Conversion fraction/decimal									
Ratio									
Interpretation of graphs									
Interpretation of tables of figures									
Statistics									
Tech. drawing interpretation									
Estimation error lengths/areas									
Estimation error figures/money									
Tolerances									
Simple geometry									
Simple trigonometry									
Simple algebra									
Speeds									
Transformation formulae									

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplement-ary
Other (Specify)									

☐ 10. Does your trade require the tradesman to write on the job? ________

What sort of writing?

☐ Notes

☐ Reports

☐ Fill in Forms

☐ Other (specify) ________________

(Omit questions 11/12/13/14/15 for employer only questionnaire.)

I'd now like to ask you some questions about the kind of reading you require of your first year apprentices.

11. When the ________________(name trade) carries out his/her job what reading does he/she do?

11a. How is the ______________________________(name trade) told what job he/she has to carry out? (Does he receive verbal or written instructions?)

☐ Verbal

☐ Written

11b. If written instructions are usually provided:
How often would he/she read them?

☐ Daily

☐ If daily, how often

☐ 2-3 times per week

☐ Weekly

☐ Monthly

11c. How important is it to read them? (Prompt 2)

☐ Vital

☐ Necessary

☐ Supplementary

(Collect sample)

11d. If necessary are detailed written instructions available to which the 1st yr apprentice may refer in order to complete the job?

☐ Yes

☐ No

11e. If detailed instructions are available -

What form are they in?

How often would the 1st yr apprentice be required to read them?

How important is the reading of such material? (Prompt 2)

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplement-ary
Trade Manuals									
Textbooks									
Journal articles									
Manufacturer's Instructions*									
Microfiche									
Video									
Other:									

11f. When a problem arises on the job are any reference materials available to which the 1st yr apprentice may refer to for help and advice?

____

____

____

____

---

* e.g. package instructions, leaflets, booklets.

11g. How does the ______________________ (name trade) locate this information?

____

____

____

____

11h. How does he/she use the reference material once he/she has found it?

____

____

____

____

12. How does the 1st yr apprentice update his knowledge on the latest developments in the trade?

____

____

____

____

(Prompt: What about reading for example, trade journals?)

12a. If reading, what kind?

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplementary
Trade Journals									
Books									
Articles									
Manuals									
Other:									

13. When the _______________________ (name trade) meets with customers is reading involved?

13a. Does the 1st yr apprentice interpret written information to customers to help in product selection?

How often would he/she be required to do this?

How important is this to the completion of the task?

(Fill in table at end of question. Prompt 2 if necessary.)

13b. Does the _______________________ (name trade) interpret illustrations (pictorial representation, usually photographic) to customers to help in product selection?

How often would he/she be required to do this?

How important is this to the completion of the task?

(Fill in table at end of question.)

13c. Does the _______________________ (name trade) interpret diagrams (line drawings) to customers to help in product selection?

How often would he/she be required to do this?

How important is this to the completion of the task?

(Fill in table at end of question.)

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplementary
13a. Product Selection									
13b. Illustrations									
13c. Diagrams									

14. Do you require your first year apprentices to write on the job? ____________________

☐ What sort of writing?

☐ Notes

☐ Reports

☐ Fill in forms

☐ Other (specify) ____________________

15. I am now going to ask you some questions about the kinds of arithmetic you expect from your first year apprentices.

How often would they be required to perform ____________________?

How important is the performance of ____________________?
(Prompt 2.)

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplementary
Mental Arithmetic									
Four Arithmetical Operations									
Metrification									
Length									
Area									
Volume									
Weight									
Angles									
Fractions									
Decimals									
Use of calculator									
Use of slide rule									
Use of tables									
Percentages									
Conversion fraction/decimal									
Ratio									
Interpretation of graphs									
Interpretation of tables of figures									
Statistics									
Tech. drawing interpretation									
Estimation error lengths/areas									
Estimation error figures/money									
Tolerances									
Simple geometry									
Simple trigonometry									
Simple algebra									
Speeds									
Transformation formulae									

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplementary
Other (Specify)									

(Omit 16/17/18/19/20 for supervisor only questionnaire.)

16. How do you go about selecting an apprentice?

17. What sort of skills are you looking for?

18. Do you use any specific criteria for selection, for example:

- the quality of the letter of application
- tests
- work experience
- personal qualities of applicant
- passes and school reports

19. Are any industry/trade tests available? ____________

If so, from whom? *

---

* Followup - "Would they be useful?"

20. Have you found a change in the quality of applicants in the past few years? ______________________________

Are they better or worse in relation to their criteria?

Look at training school?

QUESTIONNAIRE FOR FIRST YEAR APPRENTICE ON THE JOB/AT COLLEGE

1. Which trade are you apprenticed to? ______________________

____

☐ 2. What is the name of your employer? ______________________

____

(city, surburban, country) *(circle location)*

☐ 3. How many people are employed in your trade at your place of work?

____

I'd now like to ask you some questions about the kind of reading you do on the job/at college.

4a. When you carry out your job what reading do you need to do?

____

____

____

____

____

4b. How difficult do you find this reading?

☐ no problem

☐ some problems but not impossible

☐ extremely difficult

5a. How do you find out what work you are to do? Does someone tell you or do you have to read what to do off a sheet?

☐ Verbal

☐ Written Instruction

5b. Are these written instructions easy to follow?

☐ Yes

☐ No

What problems do they give you?

____

____

____

____

____

____

5c. If written instructions are usually provided -

How often would you read them?

☐ Daily

☐ If daily, how often

☐ 2-3 times per week

☐ Weekly

☐ Monthly

5d. How important is it to read them? *(Prompt 2)*

☐ Vital

☐ Useful

(Collect sample)

5e. If you are not sure how to do a job which you have been given, can you look up some written instructions which will tell you what to do?

☐ Yes

☐ No

5f. If detailed instructions are available -

What form are they in?

How often would you be required to read them?

How important is the reading of such material? *(Prompt 2)*

		FREQUENCY					HOW IMPORTANT	
	Yes/No	Daily	If daily, How often	2-3 times per week	Weekly	Monthly	Vital	Useful
Trade Manuals								
Textbooks								
Journal Articles								
Manufacturer's Instructions*								
Microfiche								
Video								
Other:								

6. When you meet with customers is any reading involved?

☐ Yes

☐ No

6a. What sort of reading is this? ______________________________

____

____

____

6b. Do you have to interpret written information to customers to help in product selection?

How often would you be required to do this?

How important is this to the completion of the task?

(Fill in table at end of question. Prompt 2 if necessary.)

6c. Do you have to interpret illustrations (pictorial representation, usually photographic) to customers to help in product selection?

How often would you be required to do this?

How important is this to the completion of the task?

(Fill in table at end of question.)

6d. Do you need to interpret diagrams (line drawings) to customers to help in product selection?

How often would you be required to do this?

How important is this to the completion of the task?

(Fill in table at end of question.)

		FREQUENCY					HOW IMPORTANT	
	Yes/No	Daily	If daily, How often	2-3 times per week	Weekly	Monthly	Vital	Useful
6b. Product selection								
6c. Illustrations								
6d. Diagrams								

7. If you require information from a text are you more likely to:

☐

- ☐ Look up the table of contents
- ☐ Look up the book's index
- ☐ Flip through the book until you come to the relevant section

8. What sort of writing are you required to do on the job/at college?

- ☐ Notes
- ☐ Reports
- ☐ Fill in forms
- ☐ Other (specify)

9. How often would you be required to write on the job?

- ☐ Daily
- ☐ Weekly
- ☐ Monthly

10. Can you give me any recent specific examples of on the job writing?

Description of task:

11. How important was writing to the completion of the task? *(Prompt 2)*

☐ Vital

☐ Useful

12. Do you talk through work related problems with those you work with?

☐ Yes

☐ No

If YES, who would you most usually talk a problem through with, your

☐ workmates

or your

☐ supervisor?

13. · I am now going to ask you some questions about the kinds of arithmetic this trade requires of you ?

How often would you be required to

perform ____________________?

Can you give me an example? ____________________

How important is the performance of ____________________? *

(a) - Mental Arithmetic

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

____

____

____

(b) - Four Arithmetical Operations

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

____________________ *

____

____

Is this the same for the first year apprentice?

⧅ tradesman

☒ tradesman and apprentice

(c) - Metrification

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: *

(d) - Length

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: *

(e) - Area

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: *

* Is this the same for the first year apprentice?

☒ tradesman

☒ tradesman & apprentice

(f) Volume

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________ *

____

____

(g) - Weight

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________ *

____

____

(h) - Angles

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________ *

____

____

* Is this the same for the first year apprentice?

⧅ tradesman

☒ " - apprentice

(i) - Use of Slide Rule

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____________________

____________________ *

____

(j) - Use of Tables

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____________________

____________________ *

____

(k) - Percentages

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____________________

____________________ *

____

* Is this the same for the first year apprentice?

☐ tradesman

☒ tradesman + apprentice

(l) - Conversion fraction/decimal

FREQUENCY

☐ Daily

☐ 2-3 times a week

☐ Weekly

☐ Monthly

IMPORTANCE

☐ Essential

☐ Useful

Example:

*

(m) - Ratio

FREQUENCY

☐ Daily

☐ 2-3 times a week

☐ Weekly

☐ Monthly

IMPORTANCE

☐ Essential

☐ Useful

Example:

*

(n) - Interpretation of Graphs

FREQUENCY

☐ Daily

☐ 2-3 times a week

☐ Weekly

☐ Monthly

IMPORTANCE

☐ Essential

☐ Useful

Example:

*

* Is this the same for the first year apprentice?
⧅ tradesman
☒ tradesman and apprentice

(o) - Interpretation of Tables of Figures

FREQUENCY

☐ Daily

☐ 2-3 times a week

☐ Weekly

☐ Monthly

IMPORTANCE

☐ Essential

☐ Useful

Example: ______________________________

______________________________ *

____

(p) - Statistics

FREQUENCY

☐ Daily

☐ 2-3 times a week

☐ Weekly

☐ Monthly

IMPORTANCE

☐ Essential

☐ Useful

Example: ______________________________

______________________________ *

____

(q) - Tech. Drawing Interpretation

FREQUENCY

☐ Daily

☐ 2-3 times a week

☐ Weekly

☐ Monthly

IMPORTANCE

☐ Essential

☐ Useful

Example: ______________________________

______________________________ *

____

*, Is this the same for first year apprentices?

⧅ tradesman

☒ tradesman and apprentice

(r) - Estimation of Error in lengths, areas, etc.

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

______________________________________ *

(s) - Estimation of error in sets of figures, money

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

______________________________________ *

(t) - Tolerances

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

______________________________________ *

* Is this the same for first year apprentices?

☒ tradesman

☒ tradesman and apprentice

(u) - Simple Geometry

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

______________________________ *

____

(v) - Simple Trigonometry

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

______________________________ *

____

(w) - Simple Algebra

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

______________________________ *

____

* Is this the same for the first year apprentice

☒ tradesman

☒ tradesman + apprentice

COLLEGE STAFF QUESTIONNAIRE

1. What is your position in the college? ______________________

____

____

2. Which trade/s are you responsible for? ______________________

____

____

3. What reading materials are used in the subject you teach at college?

Do you use ______________________________?

How often ______________________________?

How important would this reading be to the completion of the task?

		FREQUENCY					HOW IMPORTANT		
	Yes/No	Daily	If daily, How often	2-3 times per week	Weekly	Monthly	Vital	Necessary	Supplementary
Trade manuals									
Text books									
Journal articles									
Notes* College									
Correspondence									

Collect samples

---

* If notes - Who writes them? ______________________

How often are they written? ______________________

Prompt: Individual lecturer, by a team, brought in.

4. Does the reading in your subject cause any problems?

☐ Yes

☐ No

5. Can you give me some specific examples of these difficulties?

(Use textbooks/notes) ______________________________

Prompt: *vocab*
graphics
syntax
student's inability to read technical literature

6. Are these difficulties so serious that you have to alter the way you would like to teach the course?

☐ Yes

☐ No

Comment: ______________________________

7. Are there any ways in which these difficulties are being overcome at the college?

8. Are there any ways in which these difficulties could be overcome?

9. I am now going to ask you some questions about the kinds of arithmetic you require of your first year apprentice at college

How often would he/she be required to

perform ______________________________?

Can you give me an example? ______________________

How important is the performance of ______________________?

- Mental Arithmetic

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

____

____

____

- Four Arithmetical Operations

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

____

____

____

- Metrification

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

____

- Length

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

____

- Area

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

____

- Volume

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____

- Weight

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____

- Angles

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____

../

- Fractions

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____

____

____

- Decimals

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____

____

____

- Use of Calculator

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____

____

____

- Use of Slide Rule

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____________________

____

____

- Use of Tables

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____________________

____

____

- Percentages

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ____________________

____

____

— Conversion fraction/decimal

FREQUENCY

☐ Daily
☐ 2-3 times a week
☐ Weekly
☐ Monthly

IMPORTANCE

☐ Essential
☐ Useful

Example: ______________________________

____

____

— Ratio

FREQUENCY

☐ Daily
☐ 2-3 times a week
☐ Weekly
☐ Monthly

IMPORTANCE

☐ Essential
☐ Useful

Example: ______________________________

____

____

— Interpretation of Graphs

FREQUENCY

☐ Daily
☐ 2-3 times a week
☐ Weekly
☐ Monthly

IMPORTANCE

☐ Essential
☐ Useful

Example: ______________________________

____

____

- Interpretation of Tables of Figures

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Statistics

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Tech. Drawing Interpretation

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

.../.

- Estimation of Error in lengths, areas, etc.

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Estimation of error in sets of figures, money

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Tolerances

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Simple Geometry

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Simple Trigonometry

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Simple Algebra

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example:

- Speeds

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

____

- Transformation formulae

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

____

- Other (please specify)

FREQUENCY	IMPORTANCE
☐ Daily	☐ Essential
☐ 2-3 times a week	☐ Useful
☐ Weekly	
☐ Monthly	

Example: ______________________________

____

____

10. What difficulties do you encounter in teaching the arithmetic required by your course?

____

____

____

____

____

____

____

11. Are there any ways in which these difficulties are being overcome at the college?

____

____

____

____

____

____

____

12. Are there any ways in which these difficulties *could* be overcome?

____

____

____

____

____

____

____

____

____

... 15

13. What sort of writing does the first year apprentice do at college?

14. Are there any problems associated with the writing required by the course?

./15

15. What is your impression of how an employer sets about finding a suitable apprentice?*

16. What is your understanding of the selection criteria used by employers of first year apprentices?

17. What sort of skills do you think they are looking for?

---

* *Prompt: For example, "Does he advertise?"*

.../17

18. Are any trade aptitude (selection) tests available?

If so from whom?

19. Are these (in your experience) commonly used?

20. Have you found a change in the quality of apprentices over the past few years?

APPENDIX 'C'

TRADESPEOPLE ON THE JOB:

NUMERACY

TABLE 11. TRADESPEOPLE ON THE JOB : NUMERACY

APPENDIX 'C'

	Electrical Fitter Mechanic	Fitter Machinist	Motor Mechanic	Carpenter and Joiner	Painters	Cooks	Hair-dressers	Boiler Maker[1]	Plumber[1]	Diesel Fitter[1]
Mental Arithmetic	### **	### **	### **	### **	### **	### **	### **	### **	### **	### **
Four Arithmetical Operations	### **	### **	# *	# *	## **	## **	–	### **	### **	## **
Metrification	## **	### **	# *	# *		# **	### **	# **	## *	### **
Length	### **	### **	### **	### ***	### **		Estimation	Accurate # **	Accurate ### **	Accurate ### **
Area	# **	# **		### **	### **		Estimation	Accurate ### **	Estimate ## *	Estimate # *
Volume	# **	# *	# *	## **		Estimation Vital	Estimation	Estimate # *	Estimate # *	Estimate # *
Weight	## *	## **	Estimation	### **		### **	Estimation	Estimate # *	Accurate # **	Estimate ### **
Angles	# **	### **	### **	### **			Estimation	### **	### **	Estimate # *
Fractions	### **	### **	### **	### **		Estimation	### **	### **	### **	## **
Decimals	### **	### **	### **	### **		# *		### **	### **	### **
Conversion Fraction/Decimal	# *	### ***					### *	# *	– –	# *
Use of Calculator	## ***	### **	### **	# *		## **		# *	– –	# *
Use of Slide Rule							# *	–	–	–
Percentages	# ***	# *	### **		Concept Useful	## ***	Estimation	–	# *	## **
Ratio	## **	# *	# **	### **	Concept Useful	Estimation	# *	–	# *	## **
Interpretation Graphs	# **	# **		# *			## *	–	–	## **
Interpretation Tables/Figures	## **	### **	### **	## **		### **	# **	### **	## **	### **
Statistics								–		–
Technical Drawing Interpretation	### **	### **	# *	### **	## **			### **	### **	## **
Estimation Error Length/Area	### *	### **		### **	### **		### **	O	O	O
Estimation Error Figures/Money	# **		# *		# *	### **	### *	O	O	O
Tolerances	### **	### **	### **	### **				### **	## **	### **

Simple Geometry	# **	### **	### **	### **			Estimation	### **	# *	# *
Simple Trigonometry	## **	### **						# *	-	-
Simple Algebra	# **	# *						-	-	-
Speeds	## **	### **	### **					# *	# *	### **
Transformation Formula	# **	# *							-	-

USAGE

###	Daily
##	Weekly
#	Occasionally

IMPORTANCE

**	Vital
*	Supplementary

NOTE: 1. When these trades were surveyed the questionnaire had been changed, omitting questions found to be ambiguous in the first trial - questions omitted are indicated by an 'O'.

APPENDIX 'D'

READABILITY

SAMPLING PROCEDURES

READABILITY -

APPENDIX 'D'
TABLE 12.

FITTING AND TURNING I: T.A.F.E. COLLEGE NOTES

SAMPLE	TOPIC	PAGE	BEGINNING WORDS	ENDING WORDS	R.G.L.	DESCRIPTION
1.	STAGE 1. SCIENCE 1.	1.	"There is a limit ...	...faster than the speed of]"...	9.9	Functional Description
2.	LESSON 2. STAGE 3. COMMON SCIENCE	1.	"To comply with ...	... these prescribed limits of size."	11.7	Standards and Specifications
3.	LESSON 4. STAGE III. COMMON SCIENCE	2.	"The indicating unit ...	... flanks of the thread profile and the]...	10.2	Theory
4.	STAGE II. SCIENCE II. FRICTION	1.- 2.	"If we magnify two ...	to page 2 ... certain metals have]	9.9	Theory
5.	TRADE SCIENCE 1. TOPIC 19.	3.	"When a bar of metal ...	...introduced. Elasticity]	10.8	Theory
6.	TRADE SCIENCE 1.	2	"A fitter and machinist ...	(heading) ...UNITS OF MEASUREMENT	11.3	(Job Instruction) Theory
7.	STAGE II. SCIENCE II. TOPIC 3.	1.	"Temperature is the ...	... (t + 273°C Kelvin)	12.0	Theory
8.	STAGE II. SCIENCE II. TOPIC 3.	3.	"Man produces heat ...	... lower temp. Moving liquids]...	11.5	Theory
9.	STAGE I. SCIENCE I. TOPIC 14.	*1.	"The Right-Angled ...	... is the Hypotenuse... The Theorem]...	11.0	Theory - Physical Description
10.	STAGE 1. SCIENCE 1. TOPIC 2.	4.	"The lines CA, AB ...	... 3,000 Newtons]..."	10.9	Specifications and Theory
				AVERAGE READING GRADE LEVEL	10.92	

* Diagram in centre of information - Diagram notes not included.
Some Point form.

TABLE 13.

FITTING AND TURNING II: "Fitting and Machining", Vols. 1, 2, and 3. (1979 Eds.) Wilke & Co. Ltd. Victoria.

SAMPLE	VOL. & PAGE	BEGINNING WORDS	ENDING WORDS	R.G.L.	DESCRIPTION
1.	VOL. 1,p.30-31	"The accuracy of a micrometer...	...spindle D.5mm. The associated...]	10.1	Identification Physical Description
2.	VOL. 1,p.128	"If a comparison is made...	... that the correct "surface" speed...]	10.5	Identification Physical Description (Functional)
3.	VOL. 1,p.243	"cutting fluid flow is an ...	... the tool in conventional turning operations.	10.0	Functional Description
4.	VOL. 2,p.11	"In recent years, investigation ...	...it is now quite common.]	12.3	General Description
5.	VOL. 2,p.127	"For such purposes as....	... are also based upon the use]	11.0	Procedural Checkpoints
6.	VOL. 2,p.302	"Keyways are milled ...	... any side movement ..."	11.5	Identification and Physical Description
7.	VOL. 3,p. 57	"When a large number of ...	... A fixture is similar to jig, in]	10.3	Theory
8.	VOL. 3,p. 96	"Mount the work ...	...The workhead]...	10.6	Procedural
9.	VOL. 3,p.186	"All metals expand when ...	... by 11 millionths of a millimetre...]	11.1	Directions Functional Description
10.	VOL. 3.p.343	"The use of "full form"...	... is assured, but if the part]...	9.9	Functional Description
			AVERAGE READING GRADE LEVEL	10.73	

READABILITY -

APPENDIX 'D'
TABLE 14.

FITTING AND TURNING III: "Materials and Processes", (1980 Ed.) Hedges & Bell, Pty.Ltd., Victoria.

SAMPLE	PAGE	BEGINNING WORDS	ENDING WORDS	R.G.L.	DESCRIPTION
1.	2	"Iron ore deposits are ...	... 100 kilometers to Port Latta where it ..."	13.4	Theory
2.	15	"The white-iron ...	... in a neutral atmosphere. The]..."	13.0	Function Description
3.	45-46	"Many of the traditional ...	... other plastic resins have been developed from by-products."	13.4	Theory - Physical Description
4.	68	"Foam, or expanded ...	... other agents are mixed with..."	11.7	Theory - Physical Description
5.	85	"Each atom attempts ...	... to complete the outer."	11.5	Theory
6.	107	"The second law of ...	... across the surface of another".	13.2	Functional Description
7.	137	"In machines and structures ...	... then suddenly the Part."	11.6	Functional Description and Theory
8.	150	"The portion of ingot ...	... of molten metal to the mould	11.4	Functional Description
9.	208	"This is an alternative...	...the parts must be cleaned before ..."	11.1	Functional Description
10.	212	"Induction/hardening ...	... to relieve stresses."	12.4	Functional Description
			AVERAGE READING GRADE LEVEL	12.27	

APPENDIX 'D'
TABLE 15.

FITTING AND TURNING 4: "Micrometers, Vernier Calipers". Mitutoyo Mfg. Co.Ltd.
Manufacturer's Instructions

SAMPLE	PAGE	BEGINNING WORD	ENDING WORDS	R.G.L.	DESCRIPTION
1.	6.	"Selecting a best suited...	... The error is] ...	11.9	Specifications Procedural Directions

READABILITY -

APPENDIX 'D'
TABLE 16.

CARPENTRY AND JOINERY 1: T.A.F.E. COLLEGE NOTES

SAMPLE	NOTE TOPIC	PAGE	BEGINNING WORDS	ENDING WORDS	R.G.L.	DESCRIPTION
1.	SECOND YEAR BOOK 1.	23	"Fig. 1. illustrates ...	... quickly, the struts are] ...	9.1	Functional Description
2.	SECOND YEAR BOOK 1.	44	"All materials used ...	... reflector, and thus can be] ...	10.1	Functional Description
3.	SECOND YEAR BOOK 1.	97	"This may be used ...	... to remain open] ...	11.7	Procedural Direction
				Sub-average	10.3	
	FIRST YEAR THEORY 1 BOOK 3.					
4.	Topic 19 Gluing Practices		"Animal glue has ...	... first placed in pits] ...	9.3	Theory
5.	Topic 22 Sequence of Operation - Workshop Practice		"Where mis-interpretation ...	... specifications of the structure] ...	10.1	Functional Description
6.	Topic 23 Windows - Doors and Windows		"Windows provide ...	... and in the selection of] ...	10.2	Theory
				Sub-average	9.86	
7.	SECOND YEAR BOOK 3.	5	"Wedge the saw ...	... neatly onto the arbor to] ...	10.4	Procedural Directions
8.	SECOND YEAR BOOK 3.	37	"The example on Plate 1 ...	... The haunch] ...	9.3	Functional Description
9.	SECOND YEAR BOOK 3.	69	"Assure that both ...	... respective positions."	10.1	Procedural Directions
10.	SECOND YEAR BOOK 3.	149	"Suspended scaffolding...	... performed from the] ...	10.6	Functional Description
				Sub-average	10.1	
				TOTAL AVERAGE READING GRADE LEVEL	10.09	

APPENDIX 'D'
TABLE 17.

CARPENTRY 2: QUEENSLAND BUILDING ACT, 1975

SAMPLE	PAGE	SECTION	BEGINNING WORDS	ENDING WORDS	R.G.L.	DESCRIPTION
1.	6	S.13.(3)	"The erection of an ...	"the coming into ..."	11.7	Standards and Specifications
2.	58	14.2 (4)	"where a site ..."	"required to be provided"	10.2	Standards and Specifications
3.	112	11.	"protection of steel ..."	"Thickness of not less..."	9.5	Standards and Specifications
4.	144	24.29(2)	"provision at doorways"	"the location of the.."	11.7	Standards and Specifications
5.	127	22.3	"Combined vertical..."	"which extends ..."	12.0	Standards and Specifications
6.	191	5.	"Certain construction..."	"with Part 36 and having"	11.4	Standards and Specifications
7.	199	54.2	"Awings and balconies"	"access to the balcony"	10.8	Standards and Specifications
8.	47	8.2-3	"Structural drawings..."	"Notices to local authority"	12.1	Standards and Specifications
9.	94	19.6	"Draught curtains"	"shall be not less"	10.2	Standards and Specifications
10.	147	24.34(2)	"Method of measurement"	"be measured in a"	11.0	Standards and Specifications
				AVERAGE READING GRADE LEVEL	11.0	

[in format like S.A.A. Wiring Rules for electrical fitter mechanics.]

READABILITY -

APPENDIX 'D'
TABLE 18.

CARPENTRY 3: AUSTRALIAN STANDARD 1684 - 1979 S.A.A. TIMBER FRAMING CODE.

SAMPLE	PAGE	SECTION	BEGINNING WORDS	ENDING WORDS	R.G.L.	DESCRIPTION
1.	6	1 - 2	"The stresses used in...	...give close attention to]...	11.6	Standards and Specifications
2.	8	1 - 8 -1	"Where it is proposed ...	... on the leeward side]...	11.0	Standards and Specifications
3.	*12	2 - 5	"The tables of recommended ...	... pressures are permissible,]	11.7	Standards and Specifications
4.	*19	3 - 8 -1	"Joists, selected in ...	... at two points only."	10.6	Standards and Specifications
5.	*25	4 - 2 -2	"Where top wall plates ...	... points immediately above a]...	9.5	Standards and Specifications
6.	29	4 - 5	"Eaves beams or ...	... to openings of equivalent span.]	10.8	Standards and Specifications
7.	36	5 - 2 - 4.2	"Depending on the span...	... For relatively deep rafters such as]...	11.7	Standards and Specifications
8.	*42	5 - 2 -15.1	"Where a roof ...	... underpurlins and wall plates,]...	10.7	Standards and Specifications
9.	51	C.3	"Flooring, cladding ...	... ensure maximum protection from]...	11.7	Functional Description
10.	52	D.3	"Wind pressure ...	... if the roofing is, for example]	10.1	Theory
				AVERAGE READING GRADE LEVEL	9.9	

* Broken up by sub-headings

READABILITY -

APPENDIX 'D'
TABLE 19.

HAIRDRESSING: Barber-Styling Textbook Committee, *Standard Textbook of Professional Barber-Styling*, Milady Publishing Corporation, Bronx, N.Y., 1977.

SAMPLE	PAGE	BEGINNING WORDS	ENDING WORDS	R.G.L
1.	42	"While hand clippers are..."	"... the spring washer"	10.3
2.	102	"To be successful ..."	"... head contour. 3."	9.8
3.	147	"Each individual ..."	"... large design for heavy"	11.3
4.	173	"It is not enough ..."	"... stimulating massage"	11.8
5.	218	"Over-curly hair ..."	"... the hair as long"	11.7
6.	273	"Under-processing..."	"... of each curl"	11.3
7.	354	"The natural colour..."	"... about in the hair"	10.9
8.	394	"The circulatory system ..."	"... upper thin-walled"	10.7
9.	438	"A thin solution..."	"... CAUTION must be"	11.1
10.	470	"Although the importance..."	"... hair decreased intellectual"	9.9
			AVERAGE READING GRADE LEVEL	10.88

READABILITY -

APPENDIX 'D'
TABLE 20.

BARRETT, Dean. 1979. *The Van Dean Manual:* professional techniques for cosmetologists.
Milady Publishing Corporation, Bronx, N.Y.,

SAMPLE	PAGE	BEGINNING WORDS	ENDING WORDS	R.G.L
1.	11	"Your personality ...	... said to have a"	9.5
2.	41	"Shampooing the hair ...	... a regular habit"	10.7
3.	51	"The purpose of ...	... should be careful"	9.4
4.	81	"The cosmetologist ...	... thermal waving and"	11.2
5.	110	"flow are created ...	... desired holding effect"	10.9
6.	147	"Basically a wig...	... a canvas block"	9.3
7.	173	"For success in ...	... protect the hair"	13.0
8.	195	"Sometimes a patron ...	... attempt curl reduction"	10.7
9.	297	"Diseases of the nail ...	... must be exercised"	10.1
10.	358	"The principal functions ...	... necessary adjustments"	11.7
			AVERAGE READING GRADE LEVEL	